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THE

CHEMICAL NEWS

AND

JOURNAL OF PHYSICAL SCIENCE

(WITH WHICH IS INCORPORATED THE "CHEMICAL GAZETTE.")

A Journal of Practical Chemistry

IN ALL ITS APPLICATIONS TO

PHARMACY, ARTS, AND MANUFACTURES.

EDITED BY

WILLIAM CROOKES, F.R.S., &c.

VOLUME XVI.—1867.

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THE CHEMICAL NEWS.

VOLUME XVI.

No. 396.—July 5, 1867.

WITH this, the first number of the New Series of the CHEMICAL NEWS, we wish to point out to our subscribers several material alterations and improvements.

Our old type is entirely discarded in favour of the quaint, clear, and pleasing character now coming into vogue in publications of a superior kind. Messrs. Stephenson and Blake, the well-known type-founders, who have made a speciality of the old-fashioned character, have cut and cast for us a modern edition of this type, which, whilst avoiding the irregularity of thickness and outline, of type cast from matrices of the last century, retains its picturesque beauty of shape. Messrs. Stephenson and Blake have also supplied us with characteristic *barred* letters, old-style figures, and other symbols peculiar to chemical typography.

It will be observed that a great part of the CHEMICAL NEWS is now printed in a somewhat smaller type; an alteration which does not necessitate any sacrifice of legibility, as the present type is much clearer than that which we have been in the habit of employing. This apparently trifling alteration enables us to give nearly a page more additional matter.

The tinted paper on which the CHEMICAL NEWS is now printed, is not only cool, and comforting to studious eyes, but is more thoroughly in harmony with our old-fashioned type, than the glaring white, eye-damaging paper hitherto used. The quality of paper is likewise considerably improved.

In the space devoted weekly to "communications received," our subscribers will recognise the distinguished position held by various correspondents who honour us with their contributions. When an article appears without a full signature it must not be supposed that it is necessarily the production of the responsible Editor; anonymous contributions by some of the most eminent chemists of the day have often graced our columns, and our new series will be

still further enriched by original articles and reviews from distinguished men of science.

The alterations and improvements which we have just organised are of necessity costly, but the price of the CHEMICAL NEWS will remain the same as heretofore. The CHEMICAL NEWS was not established primarily as a commercial speculation. It is true that its circulation, gradually widening, has long ago made it a valuable property; but the Editor and Proprietor is far more anxious to develop its usefulness, than to "put money in his purse;" he has entered into the work solely in the interests of Science, and he is both able and willing to regard the question of profit as a secondary matter, in comparison with chemical efficiency and scientific progress.

ON THE APPLICATION OF THE BLOWPIPE TO THE QUANTITATIVE DETERMINATION, OR ASSAY OF CERTAIN METALS.

By DAVID FORBES, F.R.S., &c.

(Continued from Vol. XV., p. 282.)

Silver Assay. Cupellation Loss.—This term is applied to indicate a minute loss of silver, unavoidably sustained in the process of cupellation, which arises from a small portion of that metal being mechanically carried along with the litharge into the body of the cupel. The amount of this loss increases with the quantity of lead present in the assay (whether contained originally in the assay or added subsequently for the purpose of slagging off the copper, &c.); it is relatively greater, as the silver globule is larger, but represents a larger percentage of the silver actually contained in the assay, in proportion as the silver globule obtained diminishes in size. It has, however, been experimentally proved that in assays of like richness in silver, this loss remains constant when the same temperature has been employed, and similar weights of lead been oxidised in the operation.

In the blowpipe assay this loss is not confined to the ultimate operation of cupellation, but occurs, though in a less degree, in the concentration of the silver-lead, and in

the previous scorification of the assay, had such operation preceded the concentration. The total loss in the blowpipe assay is found, however, to be less than in the ordinary muffle assay, since in the latter case the whole of the oxidised lead is directly absorbed by the cupel.

In mercantile assays of ore it is not customary to pay attention to the cupellation loss, and the results are usually stated in the weight of silver actually obtained. Where, however, great accuracy is required, especially when the substances are very rich in silver, the cupellation loss is added to the weight of the silver globule obtained, in order to arrive at the true percentage.

The amount to be added for this purpose is shown in the annexed table, which is slightly modified from Plattner's:—

Actual per-cent- age of silver found by assay.	Cupellation loss, or per-centage of Silver to be added to the actual per-centage found by assay in order to show the true per-centage of silver contained in same. The entire amount of lead in or added to the assay being the following multiples of the original weight of assay:—															
	1	2	3	4	5	6	8	11	13	16						
99.75 }	0.25	0.32	0.39	0.45	0.50	—	—	—	—	—						
99.5 }	0.22	0.29	0.36	0.42	0.47	0.69	0.83	—	—	—						
90.....	0.20	0.26	0.33	0.39	0.44	0.64	0.75	—	—	—						
80.....	0.18	0.23	0.29	0.35	0.40	0.58	0.68	0.82	—	—						
70.....	0.16	0.20	0.26	0.30	0.36	0.52	0.61	0.74	—	—						
60.....	0.14	0.17	0.23	0.26	0.32	0.46	0.54	0.65	—	—						
50.....	0.12	0.15	0.20	0.22	0.27	0.39	0.46	0.55	0.62	—						
40.....	0.11	0.13	0.18	0.18	0.25	0.36	0.42	0.50	0.57	—						
35.....	0.10	0.12	0.16	0.16	0.22	0.32	0.38	0.45	0.51	—						
30.....	0.09	0.10	0.14	0.14	0.20	0.29	0.34	0.40	0.45	—						
25.....	0.08	0.09	0.12	0.12	0.17	0.25	0.29	0.35	0.39	0.45						
20.....	0.07	0.08	0.10	0.11	0.15	0.20	0.23	0.28	0.32	0.37						
15.....	0.06	0.07	0.09	0.10	0.13	0.17	0.19	0.23	0.26	0.32						
12.....	0.05	0.06	0.08	0.09	0.11	0.15	0.17	0.20	0.23	0.27						
10.....	0.04	0.05	0.07	0.08	0.10	0.14	0.16	0.18	0.21	0.25						
9.....	0.03	0.04	0.06	0.07	0.09	0.13	0.15	0.16	0.18	0.22						
8.....	0.02	0.03	0.05	0.06	0.08	0.12	0.13	0.14	0.16	0.20						
7.....	0.01	0.02	0.04	0.05	0.07	0.10	0.11	0.12	0.14	0.17						
6.....	0.01	0.03	0.04	0.06	0.09	0.10	0.11	0.12	0.14	0.17						
5.....	0.02	0.03	0.05	0.07	0.08	0.09	0.10	0.11	0.12	0.14						
4.....	0.01	0.02	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11						
3.....	0.01	0.02	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11						
2.....	0.01	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11						
1.....	0.01	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.10	0.11						

The use of the above table is best explained by an example, as the following:—An assay to which there had been added, in all, five times its weight of assay lead, gave a globule of silver equivalent to six per cent. Upon referring to the table it will be seen that the cupellation

percentage of silver contained in the assay is only extended to whole numbers, but fractional parts can easily be calculated from the same.

When the globules of silver are so minute that they cannot be weighed, but must be measured upon the scale, the cupellation loss should not be added, since, as a rule, it would be less than the difference which might arise from errors of observation likely to occur when measuring their diameters upon the scale.

In the case of beginners, it will be found that the cupellation is usually carried on at too high a temperature, and that thereby a greater loss is occasioned than would be accounted for by the above table. After some trials the necessary experience will be acquired in keeping up the proper temperature at which this operation should be effected.

Silver Assay.

It now becomes necessary to consider in detail the processes requisite for extracting the silver contents (in combination with lead) from the various silver ores, and other argentiferous compounds, which are met with in nature or produced in the arts.

In considering these, the following classification of the substances will be found convenient:—

I. METALLIC ALLOYS.

A. Capable of direct cupellation.

- Consisting chiefly of lead or bismuth: silver lead and argentiferous bismuth, native bismuthic silver.
- Consisting chiefly of silver: native silver, bar silver, test silver, precipitated silver, retorted silver amalgam, standard silver, alloys of silver with gold and copper.
- Consisting chiefly of copper: native copper, copper ingot, sheet or wire, cement copper, copper coins, copper-nickel alloys.

B. Incapable of direct cupellation.

- Containing much copper or nickel, with more or less sulphur, arsenic, zinc, &c.; unrefined or black copper, brass, german silver.
- Containing tin: argentiferous tin, bronze, bell metal, gun metal, bronze coinage.
- Containing antimony, tellurium, or zinc.
- Containing mercury: amalgams.
- Containing much iron: argentiferous steel, bears from smelting furnaces.

II. MINERALISED COMPOUNDS.

- Silver and other ores, furnace products, sweeps, and products of the arts containing sulphides, arsenides, and other compounds of the metals in combination with more or less earthy matter.
- Argentiferous sulphide of molybdenum.
- Substances nearly free from sulphides or arsenides, but containing chlorine, iodine, or bromine.
- Argentiferous litharge, and other easily reducible oxides.

I. A. METALLIC ALLOYS CAPABLE OF DIRECT CUPELLATION.

a. Consisting chiefly of Lead or Bismuth.—In determining the silver contained in these alloys, it is only requisite to place a clean piece of the same, weighing about from one to ten grains according to its probable richness in silver, upon a cupel of coarse bone ash, and proceed by concentration and cupellation exactly as has been already described under these heads.

Should the substance be not altogether metallic, or not free from adherent slag, earthy matter, or other extraneous matter, it should previously be fused on charcoal with a little borax in the reducing blowpipe flame, and the clean metallic globule then removed from the charcoal, and treated as before. In order to remove the globule from the inherent borax glass, it may be allowed to cool, and then detached; or, after a little practice, it will be found a quick movement of the charcoal, to cause the still melted to detach itself completely, and drop on the anvil in the form of a single somewhat flattened globule, without suffering any loss of lead adhering to the charcoal.

In the case of argentiferous bismuth alloys the process is carried on in all respects the same as if silver-lead were being treated. As, however, the bismuth globule is very brittle, care must be taken when separating the concentrated globule from the litharge, as, if not carefully done, a loss may easily be sustained from a portion of the globule remaining behind adherent to the litharge. It is better, therefore, to remove the litharge by degrees from the globule with the aid of the forceps.

Argentiferous bismuth, free from lead, when cupelled alone, invariably leaves a globule of silver, having a dull frosted surface. If, however, at the end of the operation a small quantity of lead ($\frac{1}{4}$ to $\frac{1}{2}$ a grain) be added, and fused along with it, the silver globule then obtained will be perfectly bright and free from all bismuth.

In the case of native bismuthic silver it is advisable to fuse the previously weighed mineral with a little lead and borax glass on charcoal in the reducing flame, so as to free it from any adherent earthy matter, and then proceed by concentration and cupellation, as before described.

NOTE ON THE CALCULUS OF CHEMICAL OPERATIONS.

By Professor WILLIAMSON, F.R.S.

THE remarkable memoir of Sir Benjamin Brodie, respecting which these remarks are made, is the first consistent attempt to introduce analytical reasoning into the body of the science of chemistry.

One fundamentally important question of method is raised by the memoir; and as it may be considered apart from the rest of the subject, and is, in fact, a preliminary to any discussion upon it, the author wishes to draw attention to some considerations relating to it.

Sir B. Brodie defines a chemical operation as an operation performed upon the unit of space, of which the result is a weight. The unit of matter (or molecule) adopted is the weight of matter of a specified kind, which occupies in the state of perfect gas the volume of one litre at 0°C. and a pressure of 760 millimetres of mercury.

This absolute definition is intended to supersede the prevailing theory that the molecule of each compound is the smallest proportional weight in which we can, consistently with its other properties, represent it as taking part in any reaction, or in which we can suppose it to exist by itself.

In some cases the vapour-densities of many compounds have confirmed the molecular weights assigned to them by a comparison of their reactions; but in other cases, many of which are too familiar to need mention here, the vapour-density contradicts the above evidence of the molecular weight. What is the result in such a case of conflict? Uniformly this: that if the vapour-density and reactions are irreconcilable, we know that the vapour-density must have given wrong advice, and it only remains to be seen by an examination of the anomalous vapour how the molecule broke up on evaporation.

Perhaps the best way to judge of the working of the new definition is to see the manner in which Sir B. Brodie himself applies his principle. Thus, at page 817 of his memoir, the units of thirteen substances are given, and opposite each formula is given the "absolute weight in grammes" of a litre of the vapour, and in another column the "relative weights" of each. Of these fundamental statements four only—viz.: the numbers for sulphur, sulphuretted hydrogen, sulphurous acid, SO_2 , and sulphuric acid, SO_3 , are the records of observations. The numbers for three other substances are at variance with observation, for $\text{SO}_3 \text{ H}_2$ breaks up on evaporation into SO_2 and H_2O , forming a mixed vapour of about half the density given. $\text{SO}_4 \text{ H}_2$ breaks up similarly, forming a vapour of about half the specific gravity assumed, and Nordhausen acid first breaks up into SO_3 and $\text{SO}_4 \text{ H}_2$, and this hydrate decomposes at a higher temperature, as above mentioned. The vapour from Nordhausen acid has, therefore, a specific gravity vastly below that assumed. No doubt there are good reasons derived from a study of other facts for believing that these three compounds, if they were capable of evaporating undecomposed, would have the vapour densities assigned to them by Sir B. Brodie; but taking the simple definition as given, we are led to molecular weights, which the author, in common with all chemists, considers inadmissible, and which he very properly corrects.

The other six substances of the table are more unstable compounds, which have never been evaporated without even more permanent and fundamental changes in their composition. It would be easy to multiply instances, but enough has been said to illustrate the fact that molecular formulæ are not deduced from mere vapour densities, and that we should only be justified in taking a fixed vapour volume, as the definition of molecules, if we could show that from the vapour densities of compounds their molecular weights could be inferred with certainty.

There are strong reasons against the supposition that

the molecules of chemistry can all, or nearly all, exist in the state of vapour. If we were to speculate upon the probable distribution of the elements at a temperature sufficiently high for the volatilisation of all known substances, it would be safe to assume that a very great, if not the greatest, number of known molecules would be resolved into others containing a smaller number of atoms.

Numberless known molecules are notoriously broken up at temperatures within easy reach of every operator, and there is reason to anticipate that the progress of research will gradually give us more insight into the conditions of condensation which distinguish volatile from non-volatile molecules, so as to explain why the latter cannot exist in the gaseous state.

It is, moreover, not only undesirable on the ground of accuracy, but also exceedingly inconvenient, to define chemical molecules as being one litre of vapour, for the artifice necessitates the establishment of a new scale of atomic weights and molecular weights.

The molecule of hydrogen in this scale

weighs.....	0.089
" " " oxygen	1.430
" " " nitrogen	1.251
" " " chlorine	3.173
" " " steam	0.805
" " " ammonia	0.760
" " " hydrochloric acid	1.631

The numbers represent in grammes the weight of a litre of the respective substances.

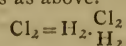
If we retain the ordinary molecular weight—viz.:

Hydrogen	2	=	H_2
Oxygen	32	=	O_2
Nitrogen	28	=	N_2
Steam	18	=	H_2O
Ammonia.....	17	=	NH_3
Hydrochloric acid ..	73	=	ClH

we have numbers which are easily remembered and easily used, and which answer all the purposes of the other numbers, in a far more convenient manner. Relations between these short numbers are seen at a glance, and computations are rapidly made with them in the head, which, with the numbers of the *crith* series of the litre, are comparatively slow and difficult. Calculations relating to any absolute measure are most easily made upon the basis of the common molecular weight. One constant has to be used for the reduction in absolute volume—viz.: 11.2 litres, or the volume, at the normal temperature and pressure, of one gramme of hydrogen. Every formula of a volatile molecule represents 22.4 litres of the vapour, weighing as many grammes as there are units in the molecular weight.

Some interesting considerations are suggested by the proposal to consider the molecule of hydrogen as containing only one atom, and the molecules of chlorine, bromine, iodine, nitrogen, phosphorus, arsenic, &c., as each compounded of one atom of hydrogen with two atoms of elements at present unknown. The formula for hydrochloric acid is $\alpha\chi$, which we may define, $\alpha\chi = \text{HCl}$, and this combined with the fundamental assumption $\alpha = \text{H}_2$, gives us $\text{H}_2\chi = \text{HCl}$, whence $\chi = \frac{\text{Cl}}{\text{H}}$. In like manner the symbol

of chlorine, $\alpha\chi_2$, may be translated into ordinary symbols by the aid of the equation $\alpha\chi_2 = \text{Cl}_2$, in which we replace α and χ by their values as above.



In explanation of the symbol $\frac{\text{Cl}}{\text{H}}$ it is merely stated that it represents an atom of chlorine from which an atom of hydrogen is removed. Chemists employ the sign of multiplication to denote combination, as in HCl , and the sign of division is here employed to indicate decomposition.

The assumption that two molecules of hydrochloric acid decompose so as to form a single atom of hydrogen,

necessarily involves for a molecule of the acid a formula like αx , representing it as one atom of hydrogen, to which another atom $\text{H} = 34\frac{1}{2}$ is united.

H_2Cl is the translation of the formula of hydrochloric acid; and when two such molecules are decomposed into hydrogen and chlorine, the process consists in removing H_2 from one of them, and combining the residue H with the other molecule of acid, forming H_2Cl_2 .

In like manner hydrobromic acid is described by the symbol H_2Br .

Bromine = H_2Br_2

Hydriodic acid = H_2I

Iodine = H_2I_2

Ammonia = H_4N

Nitrogen = H_2N_2

The author is inclined to think that the hypothesis adopted respecting the constitution of chlorine, nitrogen, &c., might, with advantage, be extended to oxygen and other atoms of even equivalence, if adopted at all, so as to represent those elements as containing hydrogen. Oxygen can be supposed to be built up from water by the addition of an increment of weight, analogous to the increment which transforms hydrochloric acid into chlorine. Water would thus be represented by a symbol of the usual form (say $\alpha_2\phi$), and the decomposition of the unit of water into two units of hydrogen, and one unit of oxygen would be represented in a manner analogous to that adopted in the case of hydrochloric acid. One unit of water would lose ϕ , liberating two units of hydrogen, which ϕ would enter into combination with the other unit of water, thereby forming $\alpha_2\phi_2$. $\alpha_2\phi_2$ is thus the symbol of oxygen, and ϕ is an element which is contained in oxygen, and which leaves it to unite with two atoms of hydrogen.

Let α represent 2 grammes of hydrogen = 22.4 litres.

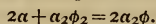
$\alpha_2\phi_2$ " 32 grammes of oxygen. = 22.4 "

$\alpha_2\phi$ " 18 grammes of steam = 22.4 "

Then ϕ is the symbol of an imaginary element, representing the increment to be added to 4 grammes of hydrogen, when they are converted into 18 grammes of water. The weight of ϕ is, therefore, 14. It may be translated thus:

$\phi = \text{O}$, and if $\alpha = \text{H}_2$, we have $2\text{H}_2 + \text{H}_4\text{O}_2 = 2\text{H}_4\text{O}$.

The following equation represents the process:



It is interesting and important to observe that Sir B. Brodie's fundamental hypothesis is an atomic hypothesis, viz., that the molecule of hydrogen consists of one atom instead of containing two atoms, as we have been accustomed to see it; and that in constructing each molecular formula he limits himself to some integral number of atomic weights.

In weighing the arguments which will, no doubt, be brought forward in favour of the proposed change, chemists will need to compare the whole of the new system to the old one. Such comparison can only be made when the new systems are before us. The author hopes, before long, to bring forward various considerations relating to the interpretation and application of our present system of chemical facts and theories. He wishes now to point out that the proposed system would be at an unnecessary disadvantage in the comparison or contest, if it were left to rest on the quicksands of conjecture respecting vapour densities.

CHEMICAL COMPOSITION OF STREET MUD.

By C. R. C. TICHBORNE, F.C.S.

The communication on the above subject, from Dr. Letheby, which appeared in the last number of the CHEMICAL NEWS, possesses to my mind considerable interest, from two causes. First—from its important sanitary aspect, and second—from the fact that last year, I endeavoured to bring prominently before the authorities of the city of Dublin, the highly deleterious nature of street dust, or mud, which from their hygienic point of view was vulgarly looked upon as harmless. In a letter published in the *Irish Times*, Tuesday, October 9, 1866, I gave the analysis of the mud taken from one of our narrowest streets, but which street was, and is to the present day, our greatest thoroughfare. The letter was written at the commencement of the severe attack of cholera with which Dublin was visited last autumn, and was published mainly with a view to advocate the use of carbolic acid for watering the roads. On referring to my notes, I find that the street dust in Dublin contained on an average 24 per cent of organic matter, which is lower than the average given by Dr. Letheby for the London mud, even allowing for difference of moisture. This lower per centage is probably owing to the much larger per centage of animals working upon the same extent of roads, or also because many of our streets are macadamized, or constructed in a similar manner. From the continual state of steeping, (if I may use the expression) and re-drying that this comminuted manure is constantly undergoing, I am of opinion that we are hardly alive to the mischief that it is capable of perpetuating. Antiseptics, such as carbolic acid, from their expense, are inadmissible for general use in the ordinary course of events. In seaport towns an efficient antiseptic, and harmless friend, would be found in the sea-water. This should be used freely for watering the streets. In dry and hot weather the saline substance very soon accumulates, and the sea-water leaves a perceptible hard crust of the briny matter. From its slightly deliquescent nature it answers its mechanical requirements admirably, and during the usual dry weather adds no expense to the work ordinarily done to restrain the dust. The three and a half per cent. of chloride of sodium &c. contained in sea-water collects rapidly when exposed to superficial evaporation, even in damp weather, and it would be next to impossible that fermentable changes could take place in the presence of so large a proportion of sea-salts.

Such a project would perhaps be hardly feasible in a city like London, which is situated so far from the mouth of the river, but it could be easily adopted in such towns as Liverpool, Portsmouth, Dublin, &c. The following analyses taken from my note book of last year, may possess some interest in connection with my remarks.

Moist Dust from Grafton-street, Dublin, October, 1866.

Moisture	33.3
Organic matter	25.1
Inorganic matter	41.6

100.0

Street Dust, October, 1866.

Soluble salts	1.3 per cent.
Organic matter	25.1

Soil from a well made road upon which sea-water had been used.

Soluble salts	7.5 per cent.
Organic matter	21.1

Here it will be seen that the salts are about $\frac{1}{4}$ the weight of the total organic matters present.

Behaviour of Lime when Burned.—Dorlhar and Saminn. Two cylinders formed out of the same piece of limestone measured 27 millimètres in length and 17 millimètres in diameter. After being completely burned their volume had increased nearly 1-10th—viz., to 28 millim. and 17.7 millim.—*Berg. und huttinn. Zeitung*, 1867.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

Baron Liebig's Artificial Milk; Death of the Patients—Liquid Diffusion applied to the Extraction of Cane Sugar—Effect of Tobacco and Snuff in Impairing Memory.

PARIS, July 3rd, 1867.

Artificial Milk.—At the last meeting of the Academy of Medicine, M. Giboust, Professor at the School of Pharmacy, read a paper which we cannot help noticing. He called the attention of the medical world to the description given of the artificial milk invented by Baron Von Liebig, and regretted very much being obliged to enter into a controversy with him. After having reminded the assembly of the composition of this milk, and insisting upon the difficulties attending the preparation of such aliments in places where it might be most necessary, such as with wetnurses or small families, M. Giboust added that we have at our disposal a natural product which more nearly resembles human milk than does a mixture of cow's milk, flour, malt, lactate and butyrate of potash. It is cow's milk itself. On an average, human milk contains a little more water, more sugar of milk, less butter and caseine than cow's milk. Thus, by taking the latter, and adding a little sugar and a fifth of its weight of water, we have an aliment, at the disposal of everybody, forming a better substitute for human milk than any artificial compound.

M. Depaul, on his part, declared that he undertook experiments on new-born children, to examine the effects of this artificial milk, the taste of which was, by the bye, less agreeable than that of natural milk. Four children were tried. The two first were twins, and born prematurely. In spite of the care bestowed on them, and the nourishment by the artificial milk, they died in two days. The third, born at full time, weighed 3 kilograms. 370 grammes; the mother was ill. The nourishment given was that of artificial milk. At the end of two days, the dejections became green, and on this day the child perished. The fourth infant, born under the same conditions, and nourished with the same aliment, died after four days. M. Wurtz promised to write to Baron Von Liebig, to obtain more precise details on the preparation of this milk.

Diffusion, by M. Robert of Seelchwitz, applied in the East Indies for the extraction of cane-sugar.—Previous to a voyage to the East Indies, he traversed Germany and Austria, with the intention of studying the progress made in the manufacture of beet-root sugar in those countries, and to see how far the method could be introduced into the East Indies, for the manufacture of cane-sugar. This process of extracting the juice of the beet-root by means of diffusion was invented by M. Jules Robert, of the firm of Robert and Co., proprietors of works situated in Moravia. Struck with the simplicity of this process, which with cheap machinery and scarcely any wear and tear, gives a finer and more abundant juice at less cost than the usual process, he consulted M. Jules Robert on the possibility of applying this method to the sugar in the East Indies, and the only difficulty was, that of having a machine to cut the cane into the required lengths, inasmuch as cane from its hardness, presented greater resistance. A cane cutting machine was constructed at Seelchwitz, which was found to work successfully on maize stalks. Four engines were sent to the East Indies, along with a triple evaporator. Up to the time of sending off the samples to the Champ de Mars, 1,500 tons of sugar-cane had been prepared. A steam engine of 12-horse power, four cane cutters, and diffusing apparatus in wood will suffice for 70 tons of sugar-cane. The advantages have been found to be:—1. Less force is necessary, for equal weights of cane, to cut the cane into slices than to drive rolling machines. 2. That diffusion extracts a juice purer than that obtained by mills. 3. That diffusion extracts from the same quantity of cane 20 per cent more juice than by mills, as is proved by the comparison of the weight of the stalks and the residues of the

diffusion. 4. As the cane contains less pectose than the beet-root, the temperature can be allowed, without inconvenience, to exceed 50°C, and even to amount to 70°C. This is important, because diffusion is quicker at a higher temperature.

Tobacco.—The Abbé Migne has just addressed a letter to a very honourable director of one of the great seminaries of Paris, condemning the use of tobacco and snuff. This letter furnishes us with an opportunity of relating a fact that is personal to us. Several times in our youth and riper age we have taken up and discarded the use of the snuffbox. In 1861, when writing our mathematical treatises, during our labours with M. Lindelof, for the calculation of variations, and when we commenced the editing of our lectures on analytic mechanics, we used snuff to excess, taking 20 to 25 grammes per day, incessantly having recourse to the fatal box and snuffing up the dangerous stimulant. The effect of this was, on the one hand, the stiffening of the nervous system, which we could not account for; on the other hand, a rapid loss of memory, not only of the present but of the past. We had learned several languages by their roots, and our memory was often at a loss for a word. Frightened at this considerable loss, we resolved in September, 1861, to renounce the use of snuff and cigars for ever. This resolution was the commencement of a veritable restoration to health and spirits, and our memory recovered all its sensibility and force. The same thing happened to M. Dubrunfaut, the celebrated chemist, in renouncing the use of tobacco. We do not hesitate in saying that for one moderate snuff-taker or smoker there are 99 who use tobacco to excess.

F. MOIGNO.

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

Copyright of the Medals—An Explanation Wanted—Awards of Gold and Silver Medals—Extract of Meat.

In our last communication we felt ourselves bound to express our opinion somewhat strongly regarding some of the more salient and least agreeable of the features of the Paris Exhibition. Grumbling comes so naturally to us English, and is therefore so completely to be expected from a "Special Correspondent," that, feeling a little ashamed to think we had fallen so easily into the conventional groove, we determined to complain no more, but proceed like Hotspur in the *Telegraph* to point out the probable winners. At this moment the following circular was placed before us:—

"Notice to Exhibitors.—The Medals.

"The Jurors' Awards, and Medals, and Honourable Mentions will be published in course of a few days, and duly notified to the successful Exhibitors.

"The copyright of the Medal being vested in us by the Imperial Commission, and fully secured for the United Kingdom (13 and 14 Vic., cap. 104, and at Stationers' Hall), we have the exclusive right to publish fac-simile copies of the Medal, as well as to supply all reproductions of the design by every process of printing, photography, embossing, electrotyping, or otherwise.

"Exhibitors desirous of introducing the medal on their show cards, labels, or other printing should favor us with instructions immediately on receipt of notice of award.

"J. M. JOHNSON AND SONS,
Sole Concessionaires."

This precious document, (precious alike in style and spirit) in one sense is to be received with enthusiasm. Henceforth who shall dare to call us "a nation of shopkeepers"? The writer contends that to sell any firm such a monopoly is eminently disgraceful. Every exhibitor then who obtains a Medal or Honourable Mention is to be forced to wait as long for his bill heads, blank invoices, or headed papers, as "M.M. the Concessionaires" please, and will

also be compelled to pay any price for them they may choose to demand. "M.M. the Concessionaires" may, for ought we know or care, be absolutely incapable of presuming unduly on their exceptional position; but, if they do not it will solely be due to their good feeling and moderation. It is more than ever evident that everything connected with the Exhibition is "sold," especially the "Exhibitors." It is generally believed, however, that "M.M. the Concessionaires" will not have the resources of their establishment too heavily taxed. "In things gone by we see the archetypes of things that are to come." *Verbum sap.*

One word more; the readers of this Journal will have observed that in its advertisement columns it is not unusual to have illustrations of Exhibition Medals. Is it then to be understood that if any English Firm, after having won a medal, should wish to have a cut of it as a heading to their advertisement, such firm will have to pay a tax to "M.M. the Concessionaires"? And are we to understand that in default they will have infringed the rights "... fully secured for the United Kingdom (13 and 14 Vic., cap. 104, and at Stationers' Hall)"? We call upon the authors of this wonderful parenthesis to define distinctly the position of advertisers in this matter. If this tax is intended to be enforced it is to be hoped that the English Medalists will refuse to lend themselves to what can only be characterised as a most odious monopoly.

It is with pain that your correspondent has felt called upon, by an absolute sense of duty, to make some of the remarks to be found in this and the last letter. It is desired, therefore, before proceeding with the criticisms upon the contents of the Exhibition, to state that despite, what has been said, the writer is deeply and most favourably impressed with the vast majority of his French experience. Red tape is always red tape; the red tapists, like Talleyrand's fair enemy, have but one defect, they are insupportable. The French people in general we cannot speak too highly of. It has been said that the grand old French politeness is disappearing: we deny it. Go where we would; we found not only civility and politeness, but kindness and good feeling. Depend upon it, where English people do not meet good treatment in France, it is because by their insular pride and *gaucherie* they render good treatment impossible. How often do we hear our countrymen use the idiotic expression "I do not like foreigners." Your true cosmopolitan does not care whether the man he meets is a foreigner or not, if he behaves well he should receive corresponding treatment. Apologising, as in duty bound, for this digression, we resume our study of the objects exhibited. As we stated in our last letter but one, we shall endeavour to take the cases as they are numbered in the Exhibition Catalogue.

In addition to cod-liver oil, Messrs. Allen and Hanbury, of Plough-court, exhibit Liebig's extract of meat, manufactured in Australia at the establishment of Mr. Robert Tooth, of Sydney, who was the first person in Australia to establish works for the manufacture of this article. Up to the present time at Mr. Tooth's works they only employ beef as the raw material. These works alone produce no less at the present time, than between 8,000 and 10,000 lbs. per month, and the resources of the manufactory are such that they are capable of yielding a much larger quantity than this.

When we reflect that 10,000 lbs. of extract represent no less than 160,000 lbs. of the lean flesh, we are in a position at once to see the amount of work that must be gone through in a short time, in order that so perishable a raw material may not be allowed to spoil.

This extract of meat is so rapidly finding its way into our kitchens, and is becoming so much used as "stock" for soups and as the basis of gravies, that it bids fair to become one of the most valuable of our imports, and it is interesting to see that the idea of concentrating a large amount of nutritious matter in a small compass is being worked out in other directions. Powdered meat is now being imported, and if of really high class quality will

probably be used in many cases where the employment of the extract would be inadmissible.

We would earnestly, however, caution the manufacturers of these essences or extracts, and powders, against allowing ever so small a quantity of bad quality to find its way into the market. Such substances are precisely those which people at first are slow to appreciate and adopt, and one or two bad samples, by disgusting the purchasers, will retard the sale within a considerable area.

We are now able to announce that no less than 88 gold, 325 silver, and 400 bronze medals have been gained by Bristol firms, and that 270 of those sources of all despair to exhibitors, viz., honourable mentions, have also been inflicted.

Among the exhibitors of chemical and pharmaceutical products the following have obtained gold medals:—

C. Allhusen, and Sons, Tyne Chemical Works, Gateshead, and Newcastle-upon-Tyne, bicarbonate, sulphate, and crystals of soda, alkali, caustic soda, chloride of lime, &c.

W. Gossage and Sons, Widnes, near Warrington, for soaps, and silicates used in making soaps.

The Farrow Chemical Company, South Shields, for specimens of chemical products.

James Muspratt and Sons 41, Oldhall-street, Liverpool, for chemical products connected with the manufacture of alkali.

Howard and Sons, Stratford, salts of quinine and other chemicals.

Price's Patent Candle Company (Limited), Belmont Works, Battersea, for candles, night-lights, oils, soaps, and glycerin.

James Young, Chemical Works, Bathgate, Scotland, for solid paraffin, candles, oils, &c.

Johnson, Matthey, and Co., Hatton-garden, for articles in platinum and other precious metals. In this instance there has been an award of what, in University language, may be called a "double first," as they have also received a gold medal in group 6, as well as a silver medal.

It is a most invidious task to criticise awards of medals in these cases. We all know how enraged every exhibitor becomes who does not get a medal. We must remember, however, that, in the first place, many of our best houses, disgusted with the labour, expense, and loss of time entailed by exhibiting, had refused to send anything to Paris. In the next place, there is no doubt that a very large proportion of the chemicals and drugs exhibited were not above mediocrity.

We regret that so much of the small space which is weekly at our disposal has of necessity been spent in discussions not immediately connected with the chemistry of the Exhibition. Now, however, that the awards are given, we hope that nothing further will arise to force us to occupy our letters with matters unconnected with science.

The following firms have obtained Silver Medals:—*Bailey, Bewicke, British Seaweed, Calvert, H. B. Condy, Cow, Hill, Denton and Jutsum, Demuth, Field, Gaskell, D. and W. Gibbs, Hopkin and Williams, Hurlet Alum Company, Johnson and Matthey, Knight, Macfarlane, Mander Brothers, Mawson, Ogleby, Parkes, Rose, Smith, Tudor, Walker Alkali Company, Warne, Wilkinson.* Bronze Medals:—*Adams, May, and Baker (Class 30), Britannia Rubber, Burgoyne, Bush, Calley, Clark, W. Cook and Co., Danley, Davy Yates and Routledge, Day and Martin, Dodge, Garrod, Goodwin, Green, Haas and Co., Hodgson and Simpson, Holland, Hosegood, Huskisson, J. Jarro, Langton and Bicknells, Lamb and Sterry, Lange and Moselle, Lowe (Manchester), M'Dougall, M'Kay, Mason, Nimmo, J. N. Parker and Co., Pulford, W. Ransome, Rogers, Rumsey, Squire, Stephens, Talbot and Alder, W. Taylor and Co., Turner and Son, Wandle, Waring.*

Class 45.—Specimens of the Chemical Processes used in Bleaching, Dyeing, Printing, and Dressing.—Silver Medal:—*Hands, Ripley.* Bronze Medal:—*Barlow, Dickens, Howe.* Honourable Mention:—*Whincup.*

REPORTS OF SOCIETIES.

CHEMICAL SOCIETY.

THURSDAY, JUNE 20.

Dr. WARREN DE LA RUE, F.R.S., President, in the chair.

IN continuation of our report of this meeting we have yet several communications remaining to be noticed.

Professor J. A. WANKLYN read a paper on "*Water Analysis; Determination of the Nitrogenous Matter*," of which Messrs. E. T. Chapman, Miles H. Smith, and himself were joint authors. Referring to the present unsatisfactory state of our knowledge respecting the decompositions and mode of detection of organic matters (and particularly those of animal origin) occurring in potable waters, the authors quote experiments which tend to prove that, by the evaporation test, the quality of an identical (bad) sample of water may appear widely different according to the rate of evaporation and the manner of applying the necessary heat in the process of analysis; and, further, when a sample of water containing urea or other sewage products, is diluted with a known proportion of distilled water the indication of impurity is not diminished in the ratio anticipated. Extracts from the Report on Metropolitan Waters by Drs. Hofmann and Blyth, 1865, and from the Discourse on Potable Waters delivered last year by Dr. W. A. Miller were read as authoritative admissions of this and similar practical difficulties. The authors further state that no reliance can be placed on Pugh's method of estimating nitric acid as ordinarily performed, and that ammonia cannot be determined in waters containing nitrogenous organic matters by any process involving the boiling with an alkali.

Direct experiments were made upon known quantities of urea, albumen, and gelatin dissolved in water, and the singular fact was disclosed that, whilst the first of these bodies is completely changed into ammonia by boiling with carbonate of soda, the two latter substances resist decomposition until caustic soda (or potash) is introduced, when one-third of the nitrogen contained in them is evolved in the form of ammonia. The remaining two-thirds of this constituent are finally liberated in the same form upon adding some crystals of the permanganate of potash and continuing the distillation. The authors employ Nessler's test for indicating the proportion of ammonia originally contained as such in the water, as well as that subsequently formed, and they rely upon the before-mentioned ratio as confirmatory of the existence of the nitrogen in this most objectionable albuminoid form. The details of operating are minutely described in the paper, and several examples are given by way of showing the application of the process. Thames water collected at London-bridge on June 18, tide two hours' flood, contained—

Grains per gallon.

Ammonia (ready formed)	·0980
Urea	·0889
Albuminous matter (equivalent to white of egg)	·8820

Other results are quoted for East London water, New River, Lambeth and Vauxhall, and water taken from the pumps in Berkeley-square and Bishopsgate-street. The PRESIDENT inquired the reason of its being found necessary to determine the ammonia separately in the distilled products obtained in the second and third stages of the operation. Why not mix these together and proceed to estimate at once the whole of the nitrogen existing in the organic form?

Professor WANKLYN, in reply, said this course might be adopted, but he considered that a valuable indication towards fixing the nature of the nitrogen was obtained by their separate examination, and this did not in practice occupy a longer time.

Dr. THUDICHUM offered some remarks on the probable

applicability of this process to the examination of the "rice-water" evacuations in cases of cholera.

Mr. DUGALD CAMPBELL said that his experiences were not in accordance with the statement just now made by Professor Wanklyn. He found that a solution of gelatin invariably gave off part of the nitrogen in the form of ammonia even upon distillation with carbonate of soda, and the results in the case of urea were not decisive, since it required an addition of caustic alkali before all the ammonia resulting from its decomposition could be expelled. Permanganate of potash had been tried by the speaker in the examination of abnormal excreta obtained in a diabetic case, but neither this agent alone, or aided by the addition of the caustic alkali, sufficed to liberate the whole of the nitrogen even when the heat applied was so great as to cause the destruction of the glass vessel.

Mr. E. T. CHAPMAN remarked that when the amount of albumen or gelatin operated upon was found considerable, it was necessary to fill up the retort once or twice with pure water, otherwise the whole of the ammonia could not be obtained by distillation. This precaution might even be required in the examination of any impure water.

Dr. COOK made a short statement in general confirmation of Mr. Campbell's remarks.

The SECRETARY then read a paper entitled "*Analysis of a Biliary Concretion, and on a New Method of preparing Biliverdine*," by Dr. T. L. Phipson. The concretion was found in the liver of a pig, and was of considerable size, being about 3 by 2 inches, and of a yellow, waxy appearance. In the natural state it contained 37 per cent of water, but after pulverisation and exposure to air it lost all but the 8 per cent shown in the analysis. Duplicate determinations were made of most of the constituents. The gall-stone had the following composition:—

Water	8·00
Cholesterine	1·35
Mucus	11·50
Hyocholate of soda, with some hyocholic acid and hyocholine	2·75
Cholepyrrhine	61·36
Carbonate of lime	1·55
Phosphate of lime	3·25
Soda	1·11
Chloride of sodium	7·13
Caprylic acid, matters not determined, and loss	2·00
	100·00

The principal constituent is the yellow colouring matter, cholepyrrhine (or bilipheine); this, on digestion with alcohol acidulated with hydrochloric acid passes into solution as biliverdine, which has a bluish-green colour, and may be separated on addition of water. The author's experiments have led him to believe that there is a close analogy between the yellow and green colouring matters of leaves and the bilipheine and biliverdine derived from animal sources. The last named body is said to differ from chlorophyll only by the elements of two equivalents of carbonic acid.

Dr. THUDICHUM said that the occurrence of gall-stones in the pig was exceedingly rare. He regarded the analogy or identity of chlorophyll and biliverdine as altogether impossible, these substances showing great differences in their optical properties as well as in their composition.

A paper, by Dr. Stenhouse, "*On the Action of Chloride of Iodine on Picric Acid*," was next read. Referring to a previous communication to the society in which the ultimate products of this action were stated to be chloropicroin and chloranil, the author has now investigated the intermediate products which could not formerly (from the manner of conducting the operation) be isolated. Three parts each of water and picric acid, together with one part of iodine, were introduced into a digesting flask through which a current of chlorine was passed, whilst the contents were maintained at a boiling temperature for several hours, and until red nitrous fumes commenced to

appear. The chloride of iodine was then distilled off and the residue in the retort heated with boiling water, from which, on cooling, crystals of dinitro-chlorophenic acid separated out. Analyses both of this acid and of the silver salt were made. Its formula ($C_6H_3Cl[NO_2]_2O$), and all its properties coincide with those observed in the product obtained by Griess when acting upon chlorinated phenol with nitric acid.

Dr. Stenhouse treated *Styphnic Acid* in a similar manner, but this gave only chloropicrin and carbonic acid, thus adding further support to a previous statement of the author "that styphnic acid is not, as Erdmann erroneously supposed, merely an oxidated picric acid, but it must have a different nucleus."

The Secretary then gave a short account of a paper, by Mr. Henry Bassett, "*On Julin's Chloride of Carbon*." Dr. Hugo Müller obtained, in 1864, a white chlorinated product by the action of pentachloride of antimony upon benzol, and gave to it the formula C_6Cl_6 , suggesting its identity with the chloride of carbon of Julin, to which Berthelot ascribed the doubtful formula $C_{10}Cl_{10}$. Mr. Bassett has now reproduced Dr. Müller's body by passing chloroform vapour through a red hot porcelain tube. It crystallises in long colourless needles, which are fusible at $231^\circ C.$, and the vapour density and analytical results were found to correspond to the formula C_6Cl_6 .

The President then adjourned the meeting until November 7, as already announced.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON SPECTRUM ANALYSIS, WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

LECTURE III.

Solar spectrum—Methods of observation—Constituents of the solar atmosphere—Spectra of the moon, and of the planets, comets, and meteors.—Inferences.

WE approach to-day the most difficult, and what may probably be considered the most interesting part of the subject which I have undertaken to bring before you—the application of the principles of spectrum analysis to the examination of the condition of the heavenly bodies. Our attention will be specially directed to the sun and some of the bodies of the solar system.

In order that I may do this with effect let me briefly recapitulate the principle facts which I have to make use of—facts which I have endeavoured to bring before you experimentally in the last two lectures.

We shall have to-day to examine the third of the classes of spectra represented in the diagram—continuous bright spectra crossed by dark lines. Now it will be remembered that every gaseous body at a sufficiently elevated temperature, has a specific spectrum. That spectrum may have its brilliancy increased as the temperature rises, and it may have new lines brought out, but it does not lose lines which it exhibits at a lower temperature. We saw that compound bodies, when sufficiently heated, were separated into their components, and that such compound bodies under those circumstances gave rise to the special spectra of their components. In many cases some of these components are of a nature which give feeble spectra, consequently the spectra of these bodies may entirely disappear from the image projected upon the screen, although the spectra of the other constituent is exceedingly plain. Spectra of the transparent elementary gases in particular are amongst those which disappear under those conditions, such as oxygen, nitrogen, and the permanent gases generally. In one or two instances, elevation of temperature brings out in these gases, spectra which differ from those produced at lower temperatures. A new spectrum is indicated at the high

temperature, which was not previously discerned. It is supposed that in these cases the change in the spectrum is accompanied by a change either in the chemical or the molecular constitution of the body by which that change is manifested.

Let me now remind you of an experiment which I showed in the first lecture, where we transmitted the light of the charcoal points through the vapour of sodium; but it will depend upon the relative temperature of the two spectra what the effect shall be. If the vapour of sodium is at a considerably lower temperature than the body behind it, which is giving the continuous spectrum, sodium vapour in this case absorbs rays corresponding in the frequency of their vibration to its own. The temperature of the sodium being only slightly raised, the light which it emits will be a little greater than that which the sodium alone would have produced, but it will be considerably less than that which would be produced by the portion of the continuous spectrum, behind, which it has absorbed; and the result is that when the image of this sodium light is thrown upon the screen, instead of having a bright line, we obtain a black line, or what appears to us a black line, that black line being really a line of low illuminating power contrasted with the spectrum of high illuminating power, and therefore producing upon our eyes the impression of a black line. The intensity of that black line will vary with the difference between the temperature of the body behind and that of the sodium by which the absorption is effected.

If the sodium be raised in temperature until it acquires the same degree as that of the body behind it, the light which falls upon the sodium will be absorbed as before; but now as the intensity of the sodium light itself is equal to that of the incident light, we shall have no sensible effect produced. Therefore the spectrum which falls upon the screen will be continuous, if the sodium be at the same temperature and equally luminous with the portion of spectrum which falls upon and is absorbed by it. But if, on the other hand, the sodium be still hotter, and be still more intensely luminous than the body behind it, it will now in its turn predominate, and instead of a black line we shall have a bright line, or a line of increased brilliancy.

Now I wish you specially to bear in mind these three conditions, which may be produced by the incandescent sodium vapour. 1. We may have a black line when the temperature of the sodium is low; or, 2, we may have no sensible effect, in which case the temperature and the light of the sodium are equal to those of the incident light; or, 3, we may have a bright line, in which case the temperature of the sodium and its light are considerably greater than those of the incident light. What is true in these respects of the vapour of sodium is also true of the vapours of all incandescent bodies. We shall see the application of these points very shortly.

Before we go directly to the consideration of the solar spectrum, let us endeavour to acquire some notion, if we can, of this vast centre of force upon which we are dependent every instant of our lives, and upon which the whole frame around us is dependent for the maintenance of its energies.

The sun, then, we must remember, is a vast body at the distance of 95 millions of miles from us, or perhaps a little less, a globe the visible disc of which is about 880,000 miles across. This wonderful globe is continually throwing forth an amount of light and heat in all directions into space. Of that light and heat we at any given moment are never receiving more than about a 2,300 millionth part: all the rest is passing into space, here and there intercepted by other planets and by other suns. But the vast mass of the light and of the heat which is being given forth from the sun is radiated into space. What becomes of it? That is a question which no one has answered, and no one can answer in the present state of our knowledge. Let us further consider that this vast globe is maintained in a state of intense incandescence. We have now to inquire whether we have any means of

ascertaining what the cause of that incandescence is; and if we do not reach so far as that, have we any means of ascertaining the composition of the matter which is in this wonderfully active state?

In an inquiry of this kind every aid that is at our command must be pressed into the service. The appearance of the sun, when viewed through a telescope, manifests to us the fact that the solar surface is in a perpetual state of violent agitation. It is not a smooth glowing mass of molten iron—nothing of the sort, for we can see that at different points upon the surface of the sun there are differences in the degrees of activity, and differences in the amount of light which it is giving out. The surface of the sun on the whole may be considered as made up of a series of what have been called bright granules, the forms of which have been variously described by different observers according to the powers of the instruments applied. But these bright granules, be it remembered, represent masses hundreds of miles in diameter. The distance of the sun is such that a circle, a single second of arc in diameter, which, according to Sir John Herschel, is the smallest surface we can see, is 467 miles in diameter. These masses of luminous matter are diffused over the surface of a substance which is much less luminous than itself. Upon the surface of the sun there are dark points which have been called *pores*. In addition to these appearances we have evidence, at intervals, of vast tornadoes or storms which appear to be taking place in this undulating luminous atmosphere. This luminous atmosphere of the sun, or photosphere as it is frequently called according to Sir John Herschel, is best conceived to consist of a quantity of very finely divided, highly luminous, cloudy matter in suspension in a transparent, slightly luminous body of air, differences in luminosity depending upon differences in the distribution of this suspended matter. I am very far from saying that this condition is maintained by an ordinary process of combustion. But I believe there is nothing which gives us a better notion of what the luminous particles of the sun may be, than is afforded by examining the product obtained when a substance is burned in oxygen, like phosphorus, which gives out a quantity of solid flocculent phosphoric acid, glowing with an intense white light by the heat evolved during combustion. The suspended matter in the sun is possibly liquid, but probably solid particles, which are deposited in this intensely-heated, but not highly luminous atmosphere, in large cloud-like masses, these masses perpetually sinking to a lower level and as continually being raised again by currents in the solar atmosphere. In order to interpret these appearances we must call to our aid every fact that we can ascertain with regard to the physical condition of the sun. We must apply the laws of physics as we have ascertained them upon the earth. We must invent no new ones to explain these phenomena, if we would proceed in the true path of philosophical inquiry.

Supposing, then, the whole disc of the sun were filled up with matter of uniform density (a very violent supposition, I grant), it must be borne in mind that the mass of the sun, taking that portion of it which we see as its luminous disc, would be represented by a mass of matter a little less than half as heavy again as water. Again, we must remember that the effect of gravity upon the surface of the sun far exceeds its power at the surface of the earth. A pound weight upon the surface of the earth would gravitate upon the sun's surface with the force of a quarter of a hundred weight, so that at the surface of the sun the effect of gravity, like that of many forces in operation upon the earth's surface, is exaggerated to a wonderful extent.

Besides these bright granules, lying between which are the dark pores or spots producing what we may regard as the ordinary appearances, we have upon the surface of the sun, as already stated, evidence of what appears to be violent tornadoes. The luminous mass which constitutes the photosphere of the sun is from time to time

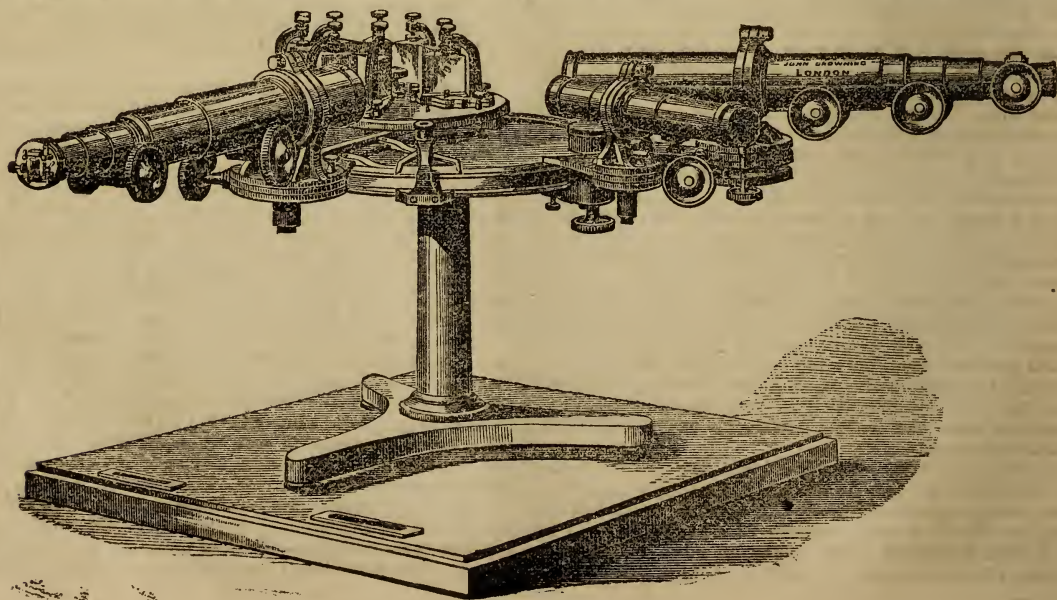
apparently torn up, and thousands, aye, hundreds of thousands of square miles of its surface are tossed aside, and a vast cavity is formed in this luminous mass. I am not saying this without warrant derived from observations upon the sun's spots, first made nearly a hundred years ago by Professor Wilson, of Glasgow, and since confirmed in a remarkable manner by the investigations which have been made since the state of the sun has been more minutely examined in modern times. The most recent examinations of this description are due to our countrymen De la Rue and Stewart, aided by Mr. Löwy. Their investigations shows us that these vast craters in the luminous surface (if the expression may be allowed) consist of two principal portions, the margin consisting of a faintly shaded portion, the *penumbra*, with a dark spot, the *umbra*, in the middle. One of the enigmas for solution is to explain what these solar spots are. Has the photosphere been heaped up to form the adjacent brilliant streaks known as *faculae*? and are these dark spots clouds of colder material which have been depressed into the photosphere, and which gradually disappear in consequence of the incandescent portions gradually again raising the clouds to their usual temperature? Are they—and I think here the evidence goes against this—are they holes in this luminous photosphere showing behind it a dark mass—the interior of the sun itself? I cannot now, however, go more minutely into the question of sun-spots; as it would be foreign to my purpose. My object is to prepare your minds by bringing before you some of the principal points in the physics of the sun, which have been ascertained from different sides by investigating the recent additions to our knowledge by the spectrum. I shall, therefore, simply now give you on the screen a representation of a photograph of the surface of the sun itself, which, it will be recollected, will be a reversed image of the sun; that is to say, where the sun is brightest we shall have in the photograph the greatest diminution of brightness. At the upper part of the disc you see a brilliant spot. That is a very characteristic sun-spot. Remembering that the most brilliant part of the screen is that which is really the darkest on the sun, you will observe in the centre of the opening the umbra of the spot. Then around that is what is called the penumbra, or more slightly shaded portion: on the other side are groups of spots which are in the process of formation or of healing up, for I do not know at what period this particular spot was taken. These cross lines on the photograph are merely lines of position showing which way the sun is moving. The spots cross the disc of the sun from left to right, and as they gradually diminish it is always found that the umbra is the first portion which disappears.

I wish, in the next place, to show you another fact connected with the sun, which recent observation has enabled us to ascertain. The sun is not simply a great glowing ball, such as it looks to us, but there is something outside the sun of which we in general take no notice, and of which until some twenty or thirty years ago we were in absolute ignorance. The phenomenon to which I am going now to direct your attention is only visible on those rare occasions when the disc of the sun is obscured by the passage of the moon between us and its body. In those cases, and under suitable conditions, we have an opportunity of ascertaining that the sun is surrounded by a vast atmosphere which is not in that intensely glowing and incandescent condition which the surface that we usually see is. I have here a photograph which represents an observation made by Mr. De la Rue in July, 1860. [The photograph was introduced.] This indicates to us the appearance which is seen when the whole disc of the sun, which is visible under ordinary circumstances, is entirely eclipsed by the moon. You will notice that round the dark body of the moon we have a remarkable halo of light, and that this halo is at certain points much more brilliant than at others,—that, in point of fact, there are clouds thrown up into this atmosphere. Some of these

clouds have been seen detached from each other. It is estimated that the height at which these clouds occur is in some cases at least 72,000 miles from the surface of the sun, so that around the sun there is a vast atmosphere invisible under ordinary circumstances, into which invisible atmosphere are projected what you see here, and what have been called red flames, clouds, probably, of incandescent matter. In this photograph the solar atmosphere is all of one uniform tint, but as actually seen, its projections, instead of being white, are of a rich red colour, and possess considerable photographic power. What the nature of these flames may be is a point on which further inquiries are necessary. It is probable that next year there will be an opportunity of making observations upon them under conditions more favourable than have ever existed since attention was directed to these points, for in the month of August there will be a total eclipse of the sun, visible in the central portions of India, which will have the unusual duration of nearly five minutes. Thus, if the atmosphere is favourable, opportunity will be given to persons properly prepared for making observations upon these flames by means of the spectroscope, and thus probably of ascertaining what the constituents are.

I will now endeavour to explain how the spectroscope will act in determining the character of these flames, and how it has enabled us to ascertain what some of the components of the sun are. We are indebted for our great stride in this direction to the observations and discoveries to Kirchhoff. Let me call your attention for a few moments to the diagram which we have here, which is intended to represent certain appearances exhibited by the solar spectrum. Suppose the light to be admitted through a vertical slit at a distance, if it be viewed after it has passed through the prism, the spectrum so obtained will be seen to be crossed by an almost countless number of dark lines. I am not sure whether these dark bands were not first observed in this very Institution, but at any rate the observation was first made by one of its most distinguished members, Dr. Wollaston. The importance of this observation was certainly not anticipated at the time it was made. He merely looked at the light coming in at the chink of a door, through a prism which he held up to his eye. Some twelve years afterwards Fraunhofer examined the solar spectrum by viewing the slit, which he placed at a distance of 24 feet from him, through a very clear prism and by means of a telescope. He then

saw not merely eight or ten bands, as Dr. Wollaston had done, but he mapped and measured nearly 600 of them, and these lines have been called after him "Fraunhofer's lines." In the diagram you see a number of letters which run along the bottom. These letters were appropriated by Fraunhofer to the indication of the most important and most prominent of the lines which he observed. Fraunhofer found that the solar lines are perfectly fixed in position in different colours, and, being an optician, he applied this observation to the purpose of determining the refractive power of the glass which he used in his lenses and prisms. These lines have always been designated by the letters which Fraunhofer gave them. Many persons have since carefully examined the solar spectrum, and some have described and mapped additional lines. Though I cannot here go into the history of this matter, I may mention particularly the names of Angström and of our own countryman, Sir David Brewster (who has latterly worked in association with Dr. Gladstone): above all we are indebted to Kirchhoff. He used an instrument exactly similar in principle to that which I described in the last lecture, the only difference being that, instead of taking a single prism as is represented in the diagram, he made the light pass through three additional prisms. The light was thrown upon his eye by a telescope. By the kindness of Mr. Gassiot I have an opportunity of showing you what I believe to be the finest instrument of the kind which has ever been constructed. It was made by Mr. Browning, and the accuracy and the workmanship have been attested by all who have used it. In this instrument the light is allowed to fall upon a battery of nine prisms, and after passing out through the last prism, it falls upon the face of the telescope, through which it is viewed by a person at the other extremity. It is clear that if we transmitted the sun's rays through such an instrument they would be opened out by the successive action of the prisms, until each line was brought out in such a way that the character of that line could be ascertained with the greatest nicety. Kirchhoff carefully mapped all these lines between A and G. They vary greatly in their strength and degree of definition. This is a curious, and at the same time an important point, and as will be seen it may be made use of in order to enable us to ascertain the origin of the lines in certain cases. As I cannot project the lines of the solar spectrum itself upon the screen, I will substitute for it a photograph of Kirchhoff's map. It is a beautiful map, but



there is considerable difficulty in rendering such fine lines visible to a large audience. [The representation of the map was produced on the screen.] You see how very greatly the lines vary in thickness, in blackness, and in definition. Some of them are as sharp as a line can be drawn, while others are broad and confused and somewhat indefinite in their outlines. Hence it is evident that these lines possess a sort of character by which they can be recognised when they are again rendered visible.

[The attention of the audience was then directed to the character of certain groups of lines, particularly in the vicinity of the lines D and C.]

Before I quit this part of the subject I shall call your attention to a beautiful photograph which indicates the exact position of these lines, as produced by the action of the sun's rays upon a collodion plate. They were taken in New York by Mr. Rutherford, from whom I received the specimen before you. When compared with Kirchhoff's maps, it is wonderful to see how perfect is the correspondence, and how faithfully those maps represent the actual lines.

I once more project the map upon the screen, for the purpose of calling your attention to the green portion. There are three lines in the green due to magnesium. Underneath this map you will see a number of letters. For example, here are the letters Fe. That is a contraction for the Latin *ferrum* (iron), and it shows that every one of these lines so marked corresponds with a bright line in the spectrum of iron. There are a number of other bodies indicated in the same way; thus, Ni signifies nickel; Ca, calcium; Cd, cadmium; Au, gold. Not that every one of these metals has corresponding lines in the solar spectrum, but Kirchhoff has examined the bright lines produced by these different bodies, and has marked the position of the solar spectrum to which these lines correspond.

I will show you now the blue portion of the spectrum which is beyond the parts at which we have just looked. This black line is Fraunhofer's line G. You see what dark groups of lines there are in this part of the spectrum. Each of these lines has its own meaning, if we can only succeed in determining it, though in many cases this has not been done.

(To be continued.)

ACADEMY OF SCIENCES.

JUNE 24, 1867.

(FROM OUR OWN CORRESPONDENT.)

M. Chevreul, president, read a letter from the Minister of Public Instruction announcing to the Academy that the election of M. Yvon de Villarsceau in the section of Geography and Navigation was approved by an Imperial decree of the 19th June.

M. Elie de Beaumont read a letter from M. Agassiz, dated last November, in which this *savant* gives details on his voyage up the river Amazon and its tributaries. He has found that that part of the American continent is formed of mud or diluvium resting on a cretaceous deposit, similar to the basin of the Seine or banks of the Somme.

M. Rouget addressed a memoir in which he differs from the opinions lately put forward on muscular contraction.

M. Thomas gave a paper on cholera remedies.

M. de Paravay, on ancient Chinese books.

M. Edward Robin, on the length of life.

M. Clausius, now in Paris, presented a copy of his work on the "Theory of Heat."

M. Velpeau sent a note by Trubart on a new mode of the introduction of medicaments. He had only made a small number of experiments, which he communicated in order to take date. For cephalalgia, ophthalmia, &c., he uses remedies introduced by the nostrils.

M. Charles Deville communicated the observations made by M. Janssen on the eruption of Santorin, and

submitted the flames to spectrum analysis. The results are, the presence of sodium in abundance, carbon, chlorine, and copper. Experiments made on Stromboli gave the same results.

M. Balard presented the work of M. Friedel on silicates and other chemical products.

M. Jules Pernot, of Avignon, sent a note on the preparation of silicates and other chemical products. He has obtained a first-class material for calico printing, &c.

M. de Pambour read a paper on hydraulic machines.

The Academy named two commissions, one for prizes for statistics and another for the Bordin prize.

M. Artur gave some explanations of his theory of the molecular actions, capillary attractions, and chemical decompositions.

M. Zalewski read a note on the method of augmenting the power of the Bunsen pile.

M. Caron criticised the artificial processes for preparing substitutes for milk, and concluded by pronouncing them indigestible and injurious to infants.

M. Daubrée read a note of M. Bonafous on the meteor seen on June 11, at 8h. 25m.

NOTICES OF BOOKS.

MINERALOGICAL PAMPHLETS.

An Index to Mineralogy. By T. ALLISON READWIN, READWIN, F.G.S., F.S.S., &c. London: E. and F. N. Spon, Charing-cross.

Royal Agricultural College, Cirencester. A Guide to the Chemical Department of the College Museum. Part I. The Mineral Collection.

Sketch of the Mineralogy of Nova Scotia, as Illustrated by the Collections of Minerals sent to the Paris Exhibition, 1867. By Professor How, D.C.L., University of King's College, Windsor, N.S. Published by authority of the Commissioners for Nova Scotia.

MR. READWIN, in the preface, states that the list is obviously imperfect, and that he hopes it will elicit correction at the hands of chemists and others. The index is a list of some 2,500 minerals, with synonymes, the constituents expressed by contractions in a small space, and the number of the case in the British Museum containing specimens. We take an example showing the method Mr. Readwin employs:—

"Eulysite (chrysolite) Mg. Sil. B. M. 36 (var. Olivine)."

By an explanation at the commencement of the book the student finds eulysite to belong to the same species of mineral as chrysolite. The remainder of the information with regard to the mineral is evident at once.

It is a little work which will be appreciated by those interested in mineralogy.

The aim of the writer of the second pamphlet—Professor A. H. Church—is merely to describe the more important minerals to be found in the museum. There is no attempt at being encyclopædic. The minerals are classed under six divisions, and the most important mineral species belonging to each division are pointed out. The information is given in a very clear and concise manner, and were it not published in the form of a guide, we should be inclined to call it brief to a fault.

It is stated by Professor How that the collections of minerals made on the present occasion are sufficient evidence that the mineralogy of Nova Scotia is very interesting both from a scientific and an economic point of view. In the first place gold is obtained in considerable quantity. Very valuable iron ores are also worked, ores yielding bar iron which ranks with the finest Swedish metal for making steel. Ores of Manganese are worked, and the value of that sent from Teny Cape up to the present equals £8,000 or £9,000. Wad, manganite and pyrolusite are exhibited. Native copper and other ores are to some extent worked. A variety of copper ores are exhibited, copper pyrites, cupiferous oxide of iron.

Galena is also represented from several localities. Mispickel is also exhibited from three or four localities, and is sometimes found in large amount; cobalt occasionally occurs with it. Barytes occurs in some places in sufficient quantity to be exported. Gypsum exists in inexhaustible profusion: natroborocalcite, and a mineral containing 59 per cent of boric acid—cryptomorphite—have been found embedded in it. Both are exhibited. Anhydrite occurs in quantity. Other products are marble, limestones, granite, sandstone, &c. The author, we think, certainly proves his opening statement.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Tungsten, properties and compounds of, (O=8).—E. Zettner. The best method of preparing pure compounds of tungsten, from the mineral, is to fuse the latter with $\frac{1}{2}$ of its weight of sodic carbonate. The fused mass is extracted with boiling water, which, on evaporation, yields crystals of the neutral sodic tungstate, $\text{NaO} \cdot \text{WO}_3 + 2 \text{aq}$. The mother-liquor, acidulated with nitric acid and evaporated, gives crystals of the acid salt, $\text{NaO} \cdot 7\text{WO}_3 + 16 \text{aq}$.

The quantitative determination of tungstic acid may be effected by adding a standard solution of plumbic acetate to an aqueous solution of tungstic acid, acidulated with acetic acid. The results are very accurate.

The atomic weight of tungsten has been deduced from the composition of ferrous and argentic tungstate; the first gave the number 92.038, the latter 91.927. Mean = 91.976 or 92.

Metallic tungsten is obtained as a dark grey powder, by melting tungstic acid together with sodium, under a cover of sodic chloride, or by passing a strong electric current through fused sodic tungstate.—(*Pogg. Ann.* cxxx. 16.)

Lead-chamber Process.—R. Weber. Sulphurous acid, in presence of much water, reduces binoxide of nitrogen to oxide of nitrogen. Sulphuric acid, of a certain strength, prevents this reaction. This explains the loss of nitric acid in the manufacture of sulphuric acid, which always takes place when the sulphuric acid in the lead-chamber is below the normal strength.—(*Pogg. Ann.* cxxx. 277.)

Fluorides of Antimony and Arsenic.—Marignac. Fluoride of Antimony forms an amorphous, gum-like mass, when evaporated in vacuo. Its concentrated solution cannot be heated without decomposition. If potassic or sodic hydrate, or ammonia, be added to a very concentrated solution of the fluoride, double fluorides in crystals may be obtained. They are nearly all deliquescent, and their solution is not immediately precipitated by sulphuretted hydrogen, acids, or alkalis. They are stable in the crystalline state, but decompose in solution, forming oxy-fluorides.

The corresponding fluo-arsenates are still more difficult to obtain in crystals. Sulphuretted hydrogen decomposes their solution slowly.—(*Arch. Science.*, 1867.)

Dissociation.—H. Debray finds that the phenomenon of dissociation may be observed in solid bodies which are formed by direct combination of a volatile and a non-volatile body.

Pure Iceland spar was heated in a tube, which could be exhausted, or filled with any gas by means of a Geisler's mercury air-pump. At 350°C the decomposition of the mineral was zero; at 440° scarcely perceptible, at 860° very distinct, but ceased when the pressure in the tube amounted to 85 mm. Heated to 1070° the pressure became stationary at 520 mm. This "tension of dissociation" is constant at a given temperature, increases with the rise of temperature, and is independent of the extent of decomposition the carbonate has undergone. If in these experiments the apparatus, after having been heated, is allowed to cool, the generated carbonic acid is entirely

reabsorbed, and a vacuum again produced. The author further finds that caustic lime, at ordinary temperatures, does not absorb a trace of carbonic acid, if the latter be perfectly dry; the absorption begins at a dark red-heat.—(*Comptes R.* lxiv. 603.)

Hydriodic Acid, action of heat on.—T. Hautefeuille. Hydriodic acid, if gradually heated, begins to decompose at 180°C, the violet colour of the gas increasing slowly up to 440°; but from 440° to 700° the decomposition proceeds rapidly. The amount of decomposed gas varies with the extent of surface. At a given temperature it is greatly increased by spongy platinum, but the latter also causes hydrogen and iodine to combine. If, at a certain temperature, equal volumes of H and I pass over platinum in the finely divided state, the quantity of the gases remaining uncombined is exactly equal to that which would be formed by decomposition, if hydriodic acid had been used. (*Comptes R.* lxiv. 608.)

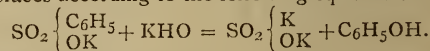
Ethers of the Acids of Arsenic (C=12).—T. M. Crafts. The reaction of silicic ethide on boric acid, studied by Friedel and Crafts, in which ethylic borate is formed, has been tried by the latter chemist with the acids of arsenic, but only arsenious acid behaves like boric acid. The action of dry arsenic acid upon silicic ethide takes place under pressure at 220°=230°C, silicic acid is precipitated, and a gas escapes which seems to be ethylene. On distillation, arsenious ethide is obtained. The residue consists of arsenious acid, silicic acid, and some arsenic acid.

Arsenic ethide, $3(\text{C}_2\text{H}_5)\text{AsO}_4$, is formed by heating ethylic iodide, diluted with twice its volumes of ordinary ether, and argentic arseniate, slightly in excess, together in sealed tubes to 120°C. The contents of the tube are extracted with ether, the ether evaporated in a current of carbonic acid, and the remaining liquid distilled under diminished pressure. Under ordinary pressure, arsenic ethide boils at 235°–238°, but decomposes partially. Its sp. gr. at 0°C is = 1.3264. It mixes with water in every proportion, showing then all the reactions of arsenic acid.

Arsenious ethide $3(\text{C}_2\text{H}_5)\text{AsO}_3$, is produced on heating silicic ethide with arsenious acid to 220° under pressure. It boils at 166°–168°. Its vapour density was found ranging from 7.197 to 7.615, according to the temperature at which it was taken; theory requires 7.267. Its sp. gr. at 0°C is = 1.224. Water decomposes it.

The ether may also be obtained from argentic arsenite with ethylic iodide.—(*Comptes R.* lxiv. 700.)

Aromatic Hydrocarbons converted into Phenols (C=12).—A. Wurtz. Sulphobenzolic acid and its analogues, melted with potassic hydrate, (250°–300°C), splits up into sulphurous acid and the respective phenol. The phenols thus obtained are very pure. The reaction takes place according to the following equation:



—(*Comptes R.* lxiv. 749.)

Crystallizable Sugar in Helianthus Tuberosus.—Dubrunfaut. The juice of the tubers of the Jerusalem artichoke, if gathered in September, contain inulin in large quantities; if reaped in March or April, it is found to contain dextrose and a non-crystallisable, inactive sugar instead. These two saccharine matters are, no doubt, produced by the conversion of the inulin, which is formed during the first period of vegetation.—(*Comptes R.* lxiv. 764.)

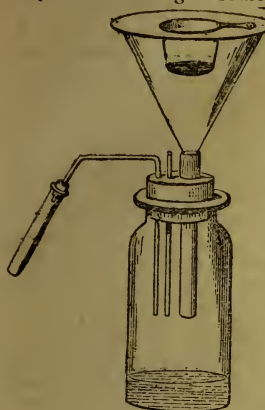
Phenol, derivatives of.—H. Brunk has prepared a series of substitution-compounds of phenol, especially those containing nitril and bromine together. Their salts crystallise well. He also describes the methylic ethers of the two isomeric nitrophenols, which he finds to be identical with mononitranisol and isonitranisol. The first is an oily liquid, the latter a crystallizable body. Both exchange their nitril for amide on reduction with tin and chlorhydric acid. The monamidophenyl-methylic ether (anisidin) is a liquid, the isamidophenol-methylic ether (isanisidin), a solid.—(*Zeitschr. Chem. N. F.* iii. 202.)

CORRESPONDENCE.

A LECTURE EXPERIMENT.

To the Editor of the Chemical News.

SIR,—The following simple apparatus which I contrived lately for illustrating the manufacture of sulphuric acid, may be interesting to some of your readers. Three tubes



are passed through the cork of a wide-mouthed bottle, the largest being connected by an india-rubber junction with a pint funnel, and the small one to the left with a test-tube generating NO by means of copper turnings and nitric acid. The middle tube admits air. A little water is poured into the bottle first, to combine with SO₂ for the production of H₂SO₄. The funnel is covered in with a metal cap to which a small pan is suspended. This pan is a miniature furnace. A bit of sulphur is placed in it and lighted. The fumes of SO₂ immediately flow down in a

conspicuous stream into the bottle. Here they encounter NO, and the usual reaction takes place. Any SO₂ which the water may dissolve is expelled by boiling, when the solution answers to all the tests for the presence of sulphuric acid. An extra cover which slides on the metal lid, conceals some air-holes, useful at the beginning of the experiment. Hoping this modification of the apparatus described by Miller for a similar purpose, may be acceptable as an exact and economical imitation of a most interesting manufacturing process,

I am, &c.,

E. S.

Nottingham, June 6, 1867.

EXTINCTION OF FIRES.

To the Editor of the Chemical News.

SIR,—Will you allow me to make a few remarks respecting a fire which took place the other day in an oil distillery at Hackney Wick? I happened to be passing at the time, and watched the progress of the flames. We all know that from whatever cause a fire takes place, water is rushed to for putting it out. In the case I refer to, the place was, as usual, drowned with water, which merely had the effect of spreading the flames and increasing their intensity, for the oil burned until there appeared to be nothing left to support the flames. Now my reason for sending you this letter is to point out how easily this fire might have been put out if a simple plan, which I shall mention, had been adopted, and there is no doubt that many similar fires could be extinguished by the same means. At the fire referred to I noticed the flaming oil floating on the surface of the water on the floors. The water running down the walls bore a flaming surface of oil likewise. This shows that the water had little or no power over the burning oil.

There was lying near the building in which the fire broke out, a large quantity of sand. Now if half-a-dozen men, provided with spades, had "dashed" a lot of this sand upon the flames soon after the fire was discovered, I have no hesitation in saying that it would have been put out, and but little damage done. But this was not the case, for long before the engines arrived, the fire had got such a hold upon the building and its contents that the firemen's work was little better than labour in vain, for the place was completely gutted. The sudden throwing of sand or any similar substance upon masses of flame proceeding from burning oil, &c., is generally sufficient to extinguish or choke them out.

Some time ago I put out a fire, which might have

destroyed an immense amount of valuable property, by simply dashing fifty or a hundred shovelfull of slacked lime, which happened to be near at hand, upon the flames, which literally choked them out. The fire in this case was caused by a cask of oil being set on fire accidentally. This is only one of the many fires which I have seen put out by adopting the same means. I consider it would be a good plan if owners of such places as oil works, &c., always had at hand a quantity of sand, dry old lime waste, &c., which could be used in the manner I have stated when necessary.

I am advancing no fancy statement, but giving your readers a plan which has been tried with every success, and I could write much in favour of this plan did I think such a course at all necessary.

I am, &c.,

T. H. SWINDELLS,
Consulting Chemist.

July 2.

MISCELLANEOUS.

The Representation of the University of London.—We have been requested to state that amongst the names of those who have been proposed to represent this University in Parliament that of Sir John Lubbock, Bart., F.R.S., has met with many warm advocates. There is no doubt that Sir John Lubbock possesses unusual qualifications for such a task; for, while his intellectual and scientific eminence would give weight to his words on questions of science, of education, and civil polity, his position in the City of London, and his reputation as a man of business, would obtain for him a hearing that might be denied to a man occupied exclusively in scientific pursuits. For the same reason he is peculiarly fitted to be the spokesman in the House of Commons of the large and increasing body of scientific men—a class whose opinions have hitherto found very inadequate expression in Parliament. We have heard the name of Dr. W. Allen Miller, F.R.S., proposed as that of a gentleman also fitted to represent this University, and should Dr. Miller be induced to come forward as a candidate, there is little doubt that he will obtain the unanimous support of the chemical fraternity; but in the event of this rumour turning out incorrect, chemists could not have a better representative than Sir John Lubbock, supported as he is by such well known men as Dr. A. Crum Brown, G. C. Foster, Dr. Odling, Dr. Pye-Smith, and H. Watts.

An American Reprint of the "Chemical News."—An announcement, of which the following is an extract, has been extensively advertised in the New York papers:—"The undersigned have the satisfaction to announce that on the 1st of July next they will begin the publication of an American reprint of the CHEMICAL NEWS AND JOURNAL OF PHYSICAL SCIENCE, the most popular and useful issue of the foreign scientific press. This valuable journal is devoted to . . . Its foremost rank as the leading representative of these interests is undisputed. . . . No interested class can now afford to be without this indispensable repository of practical science. While the reprint, in form, size, type, and engravings will be a literal copy of the original, a change will be made in the time of publication, and it will be published in monthly instead of weekly numbers. Terms ——" Meantime we have forwarded a communication to this enterprising firm which may induce them to somewhat alter their programme.

Suspension of the Storm Warnings.—We have more than once expressed our regret that the scientific committee, which has been appointed by the President and Council of the Royal Society, has advised the discontinuance of the Storm Warnings of the late Admiral Fitzroy. At the last meeting of the Literary and Philosophical Society, of Manchester, the subject was again brought forward by Mr. Baxendell, who strongly urged that the Board of Trade would again take the management of the Meteorological Department into their own hands, and ap-

point Mr. Babington, or some other competent and responsible person, to resume and carry on the system of storm warnings. As an illustration of the lamentable consequences of the suspension of storm signals, it may be stated that among the wrecks caused by the unusually heavy gale of the 10th of April, there were four vessels, which had sailed from Liverpool just before the commencement of the storm. Three of these vessels had been thrown on the Lancashire coast, and totally lost, and the lives of three of the crew of one vessel had been sacrificed. The fourth vessel had foundered in the Irish Sea, and all hands were lost. Now the meteorological phenomena immediately preceding the occurrence of this storm were of such a nature that there could have been no difficulty in giving notice of its approach in ample time to prevent the sailing of these vessels. In fact, without the aid of telegrams from distant stations, its approach was confidently announced in Manchester, so early as the evening of Monday, the 8th of April, and the direction in which the wind would blow during the most violent period of the storm was also stated at the same time.

The Paris Exhibition.—Mr. Sterry Hunt, F.R.S., the celebrated Canadian Geologist, has been made an officer of the Legion of Honour. Had its acceptance been permitted by our Government a number of honours would have been conferred, on Monday last, upon many English men of science.

The Human Voice.—Dion Boucicault, commenting on the Albert Hall of Science and Art, in the *Pall Mall Gazette*, says:—"The human voice, when speaking with clear articulation and supplied from good lungs, will fill 400,000 cubic feet of air, provided they be enclosed in a proper manner, and the voice placed and directed advantageously. The same voice singing can fill, with equal facility, 600,000 cubic feet. When singing, the vowels are principally used, because it is necessary to dwell upon a note, and we cannot prolong a consonant. In speaking, on the contrary, we depend for articulation on the consonants; but their short percussive sound does not travel. When we shout, or in open-air speaking, which partakes of shouting, we prolong the vowels, drawing the syllable of each word; but what we gain in sound we lose in clearness of articulation; expression is lost in monotony, because its fineness depends on the infinite variety of which the consonant is capable and bestows on the vowel. 2,000 voices, singing or speaking together, travel no further than one voice. They may fill a certain area more completely with that intricacy of waves which, when very troublesome, we call a din; but each voice exerts its own influence on the air, according to its power, and dies away within certain limits. A second voice acts independently, and produces its own separate effect, not fortifying the first, but distinct from it. And so with any number of voices—say 10,000—shouting together; if a single trumpeter were placed among them, the note of his trumpet would be heard clearly at a distance where the Babel of voices would have expired in a murmur. Yet, among the din produced by the 10,000 voices, the trumpet would be inaudible. To illustrate this theory more clearly, it is plain that 2,000 persons cannot throw stones further than one person. It is true that the air, within certain limits, will be more full of stones; but they will all come to the ground within a limited area."

NOTES AND QUERIES.

The use of Superheated Steam.—Sir,—About ten years since I carried out a series of experiments with superheated steam, in conjunction with an experienced engineer. In the first instance the steam was applied direct from the boiler at a pressure of 50 lbs., and passed through cast iron cylinders, heated to redness, from thence through cap welded wrought-iron pipes, to a cast iron steam jacketed pan or pot (each pot was 1½ inches in thickness, and very strongly bolted together). As soon as the superheated steam passed through the pipes, the gun metal steam taps instantly broke off short owing to the expansion. The stays to the pipes were then removed and the taps replaced. After the superheated steam had been applied to the jacketed pot for upwards of two hours, the interior pot burst from the

outer pot at the flange, and was projected through the roof of the building to some considerable distance, and the walls on each side of the building were blown down (the pot weighing about 12 cwt). Some difference of opinion existed as to the cause of the accident, as the steam was not locked in; the pot at the bottom of the pot was open, and also the valve for the outgoing steam. Perhaps the steam, being highly elastic, could not escape with sufficient rapidity. After considerable experience I have employed superheated steam with great success and most economical results both for desiccation and the evaporation of saline solutions, &c. Superheating steam does not require an expensive apparatus; it can be readily accomplished at the back of the furnace of a steam boiler, more especially where Jukes' smoke apparatus is used. A very even temperature can be easily obtained, and in operation it is even superior to Perkins' hot water apparatus, although I have not obtained so high a temperature.—W. H.

Cheap Grease.—Sir,—I am endeavouring to make cheap grease. I have succeeded in making the superior greases. But with the cheapest greases there appears to be a difficulty which I cannot master. They are sold here at 10s. 9s. and 8s. per cwt. These prices are so low that it is to me impracticable to use any other ingredients but rosin, alkali and water. But I find that grease made with these only is sticky and drying, and totally unsaleable. Can any of your subscribers give me an economical recipe for making a good, yet cheap, rosin grease, and greases which will afford a good profit when sold at the above prices?—J. S. W.

To Destroy Ants.—Sir,—Should carbolic acid fail, try liquor ammoniæ fortis: 880. This is by far the most effective for black beetles.—Q.

Charcoal Biscuits.—Sir,—To make charcoal biscuits, take flour 1 pound; carbonate of ammonia in fine powder, 1½ drachms; white sugar in fine powder, 2 ounces; mix well together—butter 2 ounces; one egg; mix into a stiff paste with new milk, and beat well with a rolling pin for 20 minutes; roll out thin and cut out the biscuits with an inverted egg cup; bake in a quick oven for 15 minutes. Levigated cedar wood charcoal is to be had of Warrick, 3, Garlick Hill, London, and ready made charcoal biscuits of Mr. Bragg, 2, Wigmore Street, Cavendish Square, London.—SUBSCRIBER.

Cure for Dry Rot in Houses.—Sir, I think there is an important oversight in the communication on this subject in your issue of 21st inst. At 27th line, should it not read "beneath the joists?" I have a remarkable instance in my mind when asphalt had been applied merely between the joists of a gentleman's mansion—these joists or sleepers were supported in the centre and nailed to wooden pegs driven about 18 inches into the soil. In about four years afterwards the whole of the lower apartments were one mass of dry rot, the said pegs having formed excellent conductors. All the woodwork was renewed, and I recommended asphalt to be spread below, and the sleepers simply to be laid upon the smooth hard surface thus formed. I believe this has always been effectual. I know a case just now where dry rot has reached the bedrooms.—W. B.

Refrigerating Machine.—Sir,—Is there any manageable machine in use for manufacturing purposes for cooling mother liquors.

ANSWERS TO CORRESPONDENTS.

All Editorial Communications are to be addressed to the EDITOR, and Advertisements and Business Communications to the PUBLISHER, at the Office, 1, Wine Office Court, Fleet Street, London, E.C. Private letters for the Editor must be so marked.

Clericus.—The powder for Larkin's magnesium lamp can be obtained at the magnesium metal company, Manchester; apply to Mr. Mellor, manager.

Querist.—Apply to F. Viewig and Son, publishers, Brunswick, for the works of Baron V. Liebig.

J. F.—The substance is sesquioxide of iron; but whether derived from the pipe or deposited from the water, we cannot say. Is the pipe corroded?

Edward O.—You will be able to obtain all the information you require by applying at the Patent Office, Southampton Buildings, Chancery Lane.

A New Subscriber.—Our first volumes can occasionally be procured second hand. Our publisher is sometimes able to secure a set. Leave your name at our office, and state how much you are inclined to give for Vols. 1 and 2.

Dr. A. L. P.—We regret that your communication is too long for our columns.

Carolus.—The acknowledgement was for receipt of money for one year's subscription.

F. Robson.—Pyrophosphate of soda in solution will dissolve sulphur, forming a polysulphide.

F. Huddersfield.—Scheele's green is arsenite of copper. Schweinfurt green is mixed arsenite and acetate of copper. If chromium green will be bright enough for what you want we certainly advise you to use it in preference.

Communications have been received from W. Briggs; W. Huskinson; Prof. Williamson, F.R.S.; F. Field, F.R.S.; Dr. Odling, F.R.S.; C. Greville Williams, F.R.S.; Dr. R. Angus Smith, F.R.S.; D. Forbes, F.R.S.; C. S. Read; P. Jessop; R. Lowe; C. R. Wright, B.Sc.; John Robinson, (with enclosure); G. F. Rodwell, F.C.S.; E. Kierman, (with enclosure); Alex. Glendinning; Professor G. G. Stokes, F.R.S.; Dr. Letheby; G. A. Keyworth; H. Bywater, (with enclosure); J. Wallace; J. H. Swindell; Professor Daubeny, F.R.S.; Joseph Davies, (with enclosure); Edmund G. Tosh, (with enclosure); Lewis Demuth and Co.; J. T. Atkinson; W. Ladd; Hood.

THE CHEMICAL NEWS.

VOL. XVI. NO. 397.

ANALYSIS OF TINKALCITE— $\text{NaO}, 2\text{BO}_3 + 2(\text{CaO}, 2\text{BO}_3) + 18\text{HO}^*$ —DETECTION OF BORON AND FLUORINE IN MINERALS.

By Professor F. WÖHLER.

AFTER estimating the water of crystallisation, dissolve the mineral in hydrochloric acid, and after neutralising with ammonia, precipitate the lime with oxalate of ammonia. Concentrate the filtrate, and estimate the boric acid in the state of double fluoride of boron and potassium.

To estimate the soda dissolve another portion of the mineral, precipitate the lime as above with oxalate of ammonia, evaporate the filtrate to dryness, and drive off the ammoniacal salt by heat. Then digest with concentrated hydrofluoric acid, evaporate to dryness, and digest with strong sulphuric acid; all the boric acid will be carried away in this operation in the form of gaseous fluoride of boron. The sulphate of soda may then be heated to redness in a crucible with a fragment of carbonate of soda.

There are some minerals which contain a rather large quantity of fluorine, silica, alumina and alkalies (principally potash): some also contain soda and lithia, micas for example. Micas being sufficiently heated to disengage fluorine, it must be noticed if they only give off fluoride of silicium, since they contain considerable quantities of silica; the coloration of the blow-pipe flame, however, will suffice to indicate the volatilisation of alkaline fluorides. If this occurs, the best plan to adopt is to perform the experiment just described, replacing the lime by silica; all the fluoride of silicium traverses the silica undecomposed, but the alkaline fluorides are arrested and changed into fluoride of silicium, which is evolved, and into silicates of potash, soda, and lithia, which remain in contact with an excess of silica. Take up the silica by distilled hydrofluoric acid; this will change it into fluoride of silicium, whilst alkaline fluorides remain behind. The alkaline fluorides are treated with sulphuric acid, and changed into sulphates of potash, soda, or lithia, and in this mixture the base is to be sought for.

When the object is therefore to determine the fluorine, one can always estimate the water and the fluoride of silicium alone or mixed.

In the case of fluoride of boron the question is not so simple; on heating, some is disengaged from tourmalines, which contain fluorine and boron. The volatile matters obtained in a tourmaline may be determined by a process analogous to that employed in the case of fluoride of silicium; the fluoride of boron being changed into a mixture of fluoride of calcium and boric acid. Unfortunately we do not know a method of estimating boron in mineral substances, especially if associated with fluorine and silicium; so that if we have fluoride of boron, fluoride of silicium, and alkaline fluorides, we can estimate the alkalies, but not the boron, silicium, and fluorine. In the absence of a quantitative method for estimating fluorine, boron, and silicium, we have an excessively delicate qualitative test. The best method of recognising the presence of fluorine consists in mixing the substance with potassic bisulphate, grinding the whole together in a small mortar, and introducing a small quantity of the paste slightly moistened into a glass tube, open at each end; place the substance at the lower part of the tube, and direct a blow-pipe flame on it so as to heat the fluoride.

Under the combined influence of the water in the bisulphate of potash, and that resulting from the combustion of the gas, there are formed alkaline sulphates, with disengagement of hydrofluoric acid. It is true that if there is a

sufficient quantity of silica, fluoride of silicium may be formed, but the result will be the same. This gas condenses with the globules of water a little beyond the part heated; if hydrofluoric acid has been formed the glass is attacked, and the same effect is produced if fluoride of silicium has been formed; in the latter case this gas changes in contact with the aqueous vapour into hydrofluosilicic acid and silica; if then the drop of water condensed with the acid is heated, the latter attacks the glass and becomes changed into fluoride of silicium. The glass tube should have been washed and dried carefully, and ought to be transparent; the same precautions must be taken after the operation.

In the case of boron the process is quite different. If no fluorine is present, mix the substance with a small quantity of fluoride of calcium and bisulphate of potash, having previously ascertained that the two reagents do not contain boron; two experiments must therefore be made, one on the reagents, and the other on the substance mixed with the reagents. The mixture is slightly moistened, and held on the extremity of a perfectly clean platinum wire. Direct the reducing flame of the blow-pipe on to the paste: at the moment when the mixture appears to boil the flame assumes a vivid green colour, characteristic of boron. When but little boron is present this must not be tried in full daylight, and it should be viewed against a dead black background; the colour of the flame will then be easily detected.

VAPOUR DENSITY OF WATER.

THE following remarks, by Mr. F. O. Ward, occur in a private letter recently addressed by that gentleman to a chemical friend. It will be perceived, by the familiarity of the style, and the cursory character of the statements, that this passage was not intended for publication. It contains, however, several indications of interest bearing upon theoretical questions which are at present strongly attracting the attention of chemical philosophers; and we believe that, in submitting it to our readers, we shall not unardonably overstep the limits of editorial discretion.

"Can you tell me on whose authority rests the assertion that water expands 1,696-fold in becoming steam at 212°F ? It is repeated from book to book, and I have repeated it myself in print (in one of the chapters of Hofmann's "Introduction to Chemistry.") It does not, however, by my reckoning, tally with the vapour-density of water, for

	Gramme.
2 litres of H at $0.0896 = \dots\dots$	0.1792
1 litre of O at $16 \times 0.0896 = \dots\dots$	14.3360
	14.5152

The 3 litres being condensed into 2 we have $\frac{14.5152}{2} = 7.2576$

as the vapour density of steam at ordinary pressure and temperature. A litre of water weighs 1,000 grammes, and $\frac{1000}{7.2576} = 1377.8$ for the expansion. Reducing the

alleged 1,696 for temperature (by $\frac{1}{460}$ per degree F).

from boiling point to $60^\circ = 152^\circ$ we have the ratio $\frac{208}{460} \times 1696 = 1266$ as the expansion so deduced, against $\dots\dots 1377.8$ as shown above.

Difference $\dots\dots\dots 110.8$ (over 8 per cent.) This is a large discrepancy, and (unless I blunder in my reckoning) it shows error in one or other of the figures compared, which ought not, therefore, both to appear (as they do, the 1696 in so many figures, the other *implicitly*.)

in the same books (*vide passim* "Fownes' Chemistry," the only one I have with me in my trunk). One question this suggests to my mind is, whether we are not going a little too fast in accepting, as we are all disposed to do, the volumetric relations of bodies as so perfectly symmetrical? Just so, some years back, we were all seduced into the pretty belief that the ponderal relations of bodies were in Prout's simple multiple ratios. Stas stemmed and turned back that false current of chemical philosophy, and we may want a Stas to keep our volumetric opinions in the path of truth!

"The differences as to volume-ratios imputed *en masse* to 'errors of observation,' may, very possibly, have in some cases, an *actual existence*."

"It may well be, indeed, that as, in music, certain minute secondary vibrations give to musical tones their vowel modifications and all the admirable varieties of *timbre* which make up our orchestral wealth; so the small deviations from symmetry in the ponderal and volumetric relations of matter, may be the very conditions of the infinite variety we observe in the modulations of chemical phenomena in those unnumbered surprises of harmony and discord to which we owe the richness and beauty of our chemical orchestra." F. O. W.

ON A POSSIBLE CAUSE OF VARIATION IN THE WEIGHTS, ATOMIC AND OTHERWISE, OF ELEMENTS AND COMPOUNDS.

By JOHN A. R. NEWLANDS, F.C.S.

M. Stas has lately remarked that "hitherto nothing has proved that the differences found in certain analyses between experiment and calculation must be *wholly* owing to error in the operation; a certain part may be due to the inexactitude of the law of definite proportions.*" It is open for us then to inquire whether any cause exists which should induce the atomic weights of two or more elements to vary in different compounds, or which should make the atomic weight of a compound greater or less than the sum of the atomic weights of its constituents.

If the attraction of gravitation were the sole force concerned in the question, and if the force of gravity be assumed to be always the same for all bodies and at all temperatures, it would seem reasonable enough to believe that the atomic weight of each element would be expressible by an absolutely invariable number, and that the atomic weights of compounds would be absolutely the sum of the atomic weights of their constituents. I of course take it for granted, in this case, that the weighings should be performed in *vacuo*, and neglect the almost infinitesimal error which might possibly be caused by the amount of the ether of space, displaced by a given weight of matter, being greater in certain forms of combination than in others.

It must not be forgotten, however, that we are living on the surface of an immense magnet, and that all, or almost all, the constituents of the earth's surface are capable of being either attracted or apparently repelled by a magnet with a force which varies with the temperature, the state of combination, &c.; the magnetic attraction of the earth being most powerfully manifested at its two colder points, *viz.*, the two poles.

Among the theoretical consequences of this state of things the following may be mentioned:—1st. A given weight of a magnetic substance would weigh more the lower the temperature, being under the influence of an increasing attraction. Thus, the oxygen of the atmosphere would, during the winter, be drawn to the earth with more force than during the summer; and also, as a general rule, be attracted more in the night than in the day.

2nd. A given quantity of an element would weigh more when in the state in which it was attracted by the magnet

than it would in another state. Thus, a given quantity of iron would weigh more in the state of black oxide than in the state of potassium ferrocyanide. The weight of a compound might, therefore, be less than the sum of the weights of its constituents; thus, the weight of ferric oxide, which is but slightly magnetic, would be less than the sum total of the weights of the iron and oxygen it contains, weighed separately, both of these being highly magnetic. By the reverse of this operation, it is possible that the weight of some compounds of certain elements, apparently repelled by the magnet, such as bismuth and thallium, might be greater than the sum of the weights of their constituents.

3rd. The magnetic attraction of the oxygen of the air above any substance might possibly reduce or augment its weight, according as it might be of a magnetic or diamagnetic character.

4th. A portion of the increase of weight which takes place when a given quantity of matter is transferred from the neighbourhood of the earth's equator to that of its poles, may be due to the increased magnetic attraction of the latter. If such be not the case, we should find the gain in weight of iron, under these circumstances, to be no greater than the gain in weight of bismuth.

5th. Admitting the existence of a variety of small bodies, or fragments of planets, meteorites, &c., of all kinds of composition, travelling through space, and approaching from time to time the earth's path in their respective orbits, we should expect to find if they were drawn to the earth by the action of gravity alone, pure and simple, that the substances so falling would be of all shades of composition. On the contrary, if they were drawn to the earth by virtue of its magnetic powers, we should find that the substances so falling would consist entirely, or at least partially, of bodies of a highly magnetic character, such as iron and nickel, and never of diamagnetic substances, such as bismuth and antimony. This latter view is corroborated, to a great extent, by the analysis of meteorites. Those who maintain that the fall of meteorites is due to gravity alone, must also believe that the proportions of iron and nickel to other kinds of matter in surrounding space is far greater than we know it to be on the earth's crust, and that the earth attracts only iron and nickel because it has nothing else to attract. The presence of hydrogen gas in some specimens of meteoric iron may be explained by supposing that the iron in question originally contained within its substance a minute amount of water, and that as it became heated by passing into the earth's atmosphere, this water was decomposed. The oxygen, under these circumstances, would unite with the iron to form black oxide of iron, and the hydrogen thus set free would be retained within the pores of the softened iron in a highly compressed state, as was the case with that found by Graham in the meteoric iron of Lenarto.

If the amount of hydrogen so liberated were very great, the heated mass would explode and split up into a number of smaller meteorites. This explosion of meteorites has also been observed.

6th. As far as the magnetic attraction of the earth is concerned, the fall of meteorites would occur mostly in the vicinity of the north and south poles. A large quantity of finely divided meteoric dust descending in this manner into the earth's atmosphere, and becoming ignited therein, might contribute to the phenomena of *aurore borealis* and *australis*.

7th. If the magnetic intensity of the earth be liable to secular variation, we should find the ordinary weights, and also the atomic weights, of substances to vary likewise.

8th. If the real atomic weights of the elements, after eliminating the magnetic action of the earth, could be obtained, we should probably be able to observe numerical relations between them of a simpler character than can at present be found. They might then prove to be multiples of a unit, without any fractions whatever, in

accordance with the idea of Prout, as modified by M. Dumas.

oth. The length of a pendulum vibrating seconds would be different if constructed of a magnetic or of a diamagnetic substance.

ON THE ACTION OF NITROGEN ON THE SILICIDES OF MAGNESIUM AND CALCIUM,

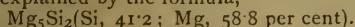
AND ON A NEW DEGREE OF OXIDATION OF SILICIUM.

By M. A. GAUTHER.

SILICIUM possesses but a small affinity for nitrogen, which affinity only becomes manifest near its fusing point. The author considered that the combination might be more easily effected by making nitrogen act on silicide of calcium, and especially on silicide of magnesium, magnesium having itself a strong affinity for nitrogen.

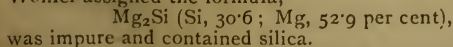
Wöhler's silicide of calcium, heated to a red white heat in a current of nitrogen, increased 5·2 per cent in weight; but the surface only of the silicide was attacked, a small quantity of nitride of calcium was formed, and the silicium separated. The crystallised silicides of magnesium, when treated in the same way, gives a black mass, which behaves like a mixture of silicide and nitride of magnesium; by the action of water it gives ammonia and magnesia, which dissolves on addition of hydrochloric acid, leaving the silicium pure; thus again, the nitrogen was only fused on the metal.

The author prepared silicide of magnesium by the action of magnesium on fluosilicate of sodium. Place at the bottom of a Hessian crucible a layer of chloride of sodium, melted and pulverised; then a mixture of 7 grammes of fluosilicate of sodium with 2½ grammes of chloride of sodium, and over this mixture 2½ grammes of magnesium in lumps. Cover the whole with melted chloride of sodium, heat the crucible quickly in a good wind furnace; when the reaction, which is lively, abates, leave the crucible in the fire five minutes, then take it away and stir the mass with a clay spatula, cover the crucible, and let it cool. Whilst the crucible is open, part of the magnesium burns in the air, giving magnesia and nitride of magnesium; the metallic button contained in the crucible is more or less rich in silicide of magnesium; when it contains an excess of magnesium, which occurs when the temperature is raised too slowly, this button may be considered as magnesium, and submitted to a new operation. First treat it with water to remove the dross, and then with a cold dilute solution of sal ammoniac, which dissolves the magnesium. Metallic crystals are easily obtained, and the silica may be mechanically separated by rubbing: they generally represent 10 per cent of the weight of the magnesium used: they are leaden grey, and seem to be regular octahedra. A hot solution of sal ammoniac attacks them, disengaging hydrogen, accompanied by silicated hydrogen, leaving a residue of silica. Hydrochloric acid completely attacks them in the cold, giving hydrogen, silicated hydrogen, and a white residue having the form of crystals, and constituting an oxide of silicium which will be noticed later. The composition of silicide of magnesium is explained by the formula,



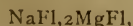
The author takes $\text{Si}=21$; $\text{Mg}=12$. In taking $\text{Si}=28$ and $\text{Mg}=24$ this formula becomes Mg_5Si_3 .

The author considers that the silicide to which M. Wöhler assigned the formula,



was impure and contained silica.

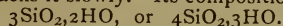
The dross formed in the preparation of this silicide contains another product, crystallised in cubes, insoluble in water, and which is a double fluoride of sodium and magnesium:



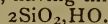
which may also be obtained by melting chloride of magnesium with fluoride of sodium in excess, and chloride

of sodium. The crystals of silicium which accompany them may be removed by treating them with a mixture of hydrofluoric and nitric acids.

Oxide of Silicium.—This oxide, which is formed by the action of hydrochloric acid on silicide of magnesium, has already been indicated by Wöhler, who had obtained it by the action of hydrochloric acid on the silicide, but he did not give its composition. Prepared with pure silicide, it is perfectly white, and possesses all the qualities indicated by Wöhler. Treated with potash, it disengages hydrogen; heated in a tube, it leaves amorphous silicium, and gives a gas which smokes in the air. It is not attacked by concentrated and boiling sulphuric acid: nitric acid attacks it slowly. Its composition is—



By operating with the greatest precaution, and by taking care that the temperature does not pass 0° when attacking the silicide of magnesium by hydrochloric acid, hydrated oxide may be obtained, having this composition:



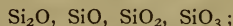
In taking $\text{Si}=28, \text{O}=16$, these formulæ become $3\text{Si}_3\text{O}_4, 4\text{H}_2\text{O}$; $2\text{Si}_3\text{O}_4$ and $\text{Si}_3\text{O}_4, \text{H}_2\text{O}$.

According to the author these bodies are very different from the *leucon* of M. Wöhler. *Leucon* is richer in hydrogen and silicium than the preceding compound; according to MM. Geuther and Sheerer it is a hydrate;

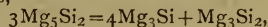


Thus it is $\text{Si}_3\text{O}_2, 2\text{H}_2\text{O}$.

After a discussion, which it would be difficult to resume here, the author concluded that there were four oxides of silicium:



Or with $\text{Si}=28$, and $\text{O}=16$: Si_3O ; Si_3O_2 : Si_3O_4 ; SiO_2 ; and for the silicated hydrogen, SiH_2 ; the silicide, Mg_5Si_2 , becomes $\text{Mg}_5\text{Si}_3=2\text{Mg}_5\text{Si}+\text{MgSi}$. He admits that the silicated hydrogen is H_3Si_2 , and that the silicide of magnesium, Mg_5Si_2 , ought to be regarded as a combination of two silicides,



only the silicide, Mg_5Si_2 , taking part in the reaction which produces the silicated hydrogen, whilst the silicide, Mg_5Si_3 , gives rise to the hydrate, $2\text{SiO}_2, \text{HO}$.

ON THE LOSS OF SULPHURIC ACID IN SALT-CAKE MANUFACTURE.

By CHARLES R. A. WRIGHT, B.Sc.

MORE or less sulphuric acid is always lost in the process of conversion of sodium chloride into sulphate, through the mechanical effect of the escaping gases in carrying off vesicles of acid and sulphate spirted up; in the roasters also a portion of sulphuric acid is volatilized as such, especially if so much acid have been added as would be necessary to convert the whole of the sodium chloride into sulphate. The total amount thus lost necessarily varies in different instances, being dependent on the form of pot and roaster used, the mode of applying heat, &c.; and especially on the amount of salt left undecomposed in the salt-cake. When ordinary salt-cake is withdrawn from the roaster, a white cloud or vapour is emitted from it; when the amount of acid originally added is sufficient to decompose all the sodium chloride present, and when the roasting has been carried so far as to decompose from 98 to 99 per cent of the chloride, the escaping vapour contains mostly sulphuric acid with but little hydrochloric; if more sulphuric acid have been originally added, and the roasting carried so far as to leave only 1 to 1·5 per cent of "free acid," a good deal of sulphuric acid is given off from the salt cake on withdrawal from the roaster; whilst, if less than the requisite amount of sulphuric acid have been originally added, so that 4 to 6 per cent of the sodium chloride remain undecomposed, the vapours emitted consist chiefly of hydrochloric acid.

Some experiments made on this subject by the writer, together with some similar details kindly furnished by different manufacturers, yielded the following results:—

Nature of Furnace, &c., used.	Average per-centage of undecomposed salt in the salt cake.	Approximate amount of sulphuric acid lost out of 100 parts originally used.
1) Open Furnace	0.60	12.6
2) Blind furnace: one pot.		About 6
3) Ditto ditto	3.40	Less than 1
4)* Ditto ditto	5.00	1.0
5) Ditto two pots	3.00	2.4

As might be anticipated, there seems to be a greater amount lost with an open furnace than with a blind one; apparently also when salt-cake containing 95 per cent of available sodium sulphate (*i.e.*, 5 per cent of sodium chloride, "free acid," ferric oxide, moisture, &c.) is manufactured in blind furnaces, the average amount of sulphuric acid lost is about 2 parts in 100. Such salt-cake will contain about 54.5 per cent of SO_3 , and consequently 100 parts of salt-cake will require for its production about $54.5 + 0.02 \times 54.5$ or 55.6 parts of SO_3 . Acid of specific gravity 1.591 at 15°C . contains 55.6 per cent. of SO_3 (Bineau); hence a kilogramme of such salt cake represents a kilogramme of sulphuric acid of sp. gr. 1.591; or 0.68 kilogram of SO_4H_2 .

It may be noticed that in (4), the SO_3 present in the shape of sodium sulphate in the condensed muriatic acid was only about one-sixth of the total amount; hence indicating that the majority was derived from the roaster where the heat would be sufficient to volatilize SO_4H_2 as such; the mechanical transfer of vesicles spirited up, is however evidenced by the presence of perceptible amounts of sodium compounds in the gases passing off from the pot.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

Artificial Milk; Manufacture of it in England; Analysis Disputed.—Report of the Weights, Measures, and Coins Committee; Official Recommendations.—New Process of Evaporation.—Improvements in Electrotyping Copper.

PARIS, July 10, 1867.

At the last meeting of the Academy of Medicine two protestations were again made against the artificial milk of Baron Liebig. The first is by M. Boudet. The second objection was raised by M. Poggiare, in the following terms:—Baron Liebig tells us that his artificial milk is manufactured on a large scale in England; that there is an industrial Company which carries on the business on a large scale. The important point to be considered is, whether this new product differs widely in composition from human milk. Baron Liebig has taken as the basis of his preparation that of a milk analysed by a German chemist, named Haideln. This analysis is very old, and when it was made scientific men were not provided with the means which are now at their disposal; and the results have, therefore, been contested.

Nevertheless, in accepting, and taking for granted the truth of Haideln's analysis, we observe that in the formula of M. Liebig the plastic elements are represented by 10, and the respiratory elements by 38, instead of 24 required by the analysis of M. Haideln. The composition of the artificial milk thus differs much from the true proportions, and in this respect it is inferior in quality to natural milk. In it the fatty matters are replaced by starch. But glycose, it is well known, gives less heat, and therefore cannot replace advantageously the substances we have mentioned. We may also ask why

*Deducted from the average composition of salt-cake and condensed muriatic acid.

does Baron Liebig add bicarbonate of potash? this new element gives to the milk a taste far from agreeable. In a word, this artificial milk differs from the natural, by its odour, taste, colour, and chemical composition. We should certainly recommend, in preference to it, milk which is most similar in composition to human milk, namely, cows', goats', and asses' milk.

The Committee of Weights, Measures, and Coins, at the Universal Exhibition of Paris, 1867, have made their official report relative to units of measure and weight. The commission advance the following measures:—The prompt substitution, in all its integrity, of the metric system, for the old systems of weights and measures, as it is practically adopted in several other countries in the west of Europe. This system, introduced and legalised optionally, cannot be at once rendered imperative to the exclusion of every other system. A certain delay is necessary for the change; and the different nations are alone capable of fixing its duration. Let us observe in the meantime that experience in several countries has proved that a too long delay does not have the effect of sensibly facilitating the accomplishment of this task. Thus it is desirable that Governments take, henceforth, the following measures, viz.:—

1. To order the teaching of the metric system in public schools, and to require that it should form part of the public examinations.

2. To introduce its use into scientific publications, in public statistics, in postal arrangements, in the custom houses, and other branches of Government administration.

3. The commission does not consider, as appertaining to its mission, the duty of making standards the exact prototypes of those of Paris. The Government of each country will take upon itself the verification of each of these standards.

The commission declares that the present report contains the expression of its deliberations and conclusions. It expresses a wish that different nations will yield to the solicitations of science and the manifestations of opinion.

A new evaporating process is carried on by M. E. Parion, at Wardreques, St. Omer. This process is carried on essentially by the renewal of the surface of the liquid exposed, in the state of fine division, in contact with the air, or the products of the combustion according as the evaporation should take place, with or without the aid of artificial heat. When the evaporation takes place by the aid of the temperature of the air alone, the liquids are divided into a small shower exposed to the wind and sun. By maintaining them in this state, we obtain in a small space, and one easy to cover when necessary, the same results as the concentrating basins and the graduating buildings give, at great cost, and with a vast extent of land.

In the case of the employment of artificial heat, the waste heat from chimneys of factories is utilised in preference, and in the absence of this any source of heat is employed if the products obtained have a sufficient value to pay the expenses.

The reduced model of the apparatus for evaporating by the aid of artificial heat, is exhibited at the Universal Exhibition, class 50, group VI.; moreover, a small apparatus is at work in the annexe at Billancourt.

M. Bouillet has discovered a remedy for a defect in the electro deposition of copper, which is sometimes seriously injurious, viz., its brittleness. He has found that a very small quantity of gelatin dissolved in the bath gives a copper of nearly equal malleability to rolled copper, whereas the pure bath only gives a porous defective metal like cast copper. The relative specific gravities of copper in different states are: cast copper, 8.78; laminated copper, 8.95; galvanic copper, 8.86. Gutta-percha moulds are exclusively used by the firm of Christophle and Co. They are applied, either cold by pressure with a lever, or by the hand. The mould is rendered conductive either by black-lead or silver, reduced from the nitrate by nascent hydrogen. F. MOIGNO.

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

Messrs. C. Allhusen and Sons, of the Tyne Chemical Works, Gateshead, and of Newcastle-upon-Tyne, obtained a medal in Class II. Section A. for their display in the English Exhibition of 1862, and that they fully sustain their old position is evident from their present exhibition illustrating the manufacture of soda. They show bicarbonate, sulphate, and crystals of soda, alkali, caustic soda, of 60 and 70 per cent, chloride of lime, &c. As we stated in our last, they have obtained a gold medal for the superior quality of their productions.

It is both interesting and instructive to study the mechanical and chemical requirements of one of these colossal chemical manufactories. We all know the enormous space required for vitriol chambers, and the absorption apparatus for making chloride of lime. In addition to this, which alone forms an immense plant, there are actually saw-mills, common and fire-brick manufactories, coke-ovens, and gas-works, besides, of course, an extensive cooorage. Such is the nature of Messrs. Allhusen and Sons' "plant," and they are, we believe, by no means the largest manufacturers of their class. After this we shall not be surprised to hear that their weekly consumption of raw material is as follows:—

Coal	2,250 tons.
Pyrites	350 "
Nitrate of soda	10 "
Chalk.....	900 "
Salt	450 "
Manganese	100 "
Limestone	125 "

The weekly production of sulphate of soda is 500 tons, equivalent to 375 tons of soda ash or unrefined alkali; which is in subsequent processes converted into quantities varying with the demand, and not exceeding separately 450 tons of crystals of soda, 150 tons refined alkali, 100 tons bicarbonate soda, 30 tons caustic soda, and 110 tons chloride of lime.

So much has been written and said about the soda process, that it is entirely unnecessary to enter upon the subject here, except to say that in spite of the innumerable attempts that have been made to supersede Leblanc's method, it is still adhered to by all manufacturers of soda. It is true that Mr. W. Gossage, of Warrington, (whose name has been so long and intimately connected with the alkali manufacture) has devised a new plan which appears to have the germs of success in it; but whether it is absolutely a commercial success, we are not at the present moment aware. This much is certain, that the new process cannot be in the hands of anyone more aware of the difficulties lying in the way, or better prepared successfully to encounter them.

Vauquelin a very long time ago endeavoured to take advantage of a reaction which even appears to have been known to the alchemists, namely, that when chloride of sodium is heated to a high temperature in presence of silica and water vapour, hydrochloric acid is evolved and a silicate of sodium formed. The production of soda from this silicate is a problem that has attracted a vast number of chemists, but, up to the present time, unsuccessfully. Tilghmann in 1847, and Fritzsche in 1858, have both attacked the question, but, as far as we know, with no material advantage.

Mr. Gossage subjects the silica to the action of chloride of sodium *in the state of vapour*, and in an atmosphere of steam. This is effected by sending the steam and the vapour of the salt into a large tower lined with fire brick and filled with flints. The silicate of soda flows down, thus exposing a fresh surface of the flint to the action of the vapour. The silicate of soda has to be decomposed by either carbonic acid or lime. The details of this part of the process are not in our possession at present, and from the known difficulties which lie in the way, must be

very ingenious and instructive; we hope, however, to be able to lay a complete account before our readers at no distant period.

Mr. Gossage has most deservedly had his labours recognised, he being one of the few English exhibitors of chemical products who have been awarded a gold medal.

Before proceeding any further in our notices of the English exhibitors, we must once more express our deep regret that none of the manufacturers of aniline dyes were represented. When we remember the part that England has taken in the discovery and investigation of coal tar colours, it is almost humiliating to see the brilliant cases of foreign manufacturers, whose only part in the matter has been to infringe our patents, and by deluging the market with cheap, and in most cases inferior colours, bring the trade to the verge of ruin. This remark, be it understood, is not intended to apply to the French chemists, who, it must be admitted, have treated us with far more justice than our German brethren. We looked in vain for a specimen of the superb Britannia violet of the MM. Perkin, which for two years has been the most successful rival of Hofmann's violets. For a long time its extreme solubility in water (almost as great as ordinary "Hofmann" in spirit) made it stand alone, but we believe that M. Porrier's violet from methyl-aniline is also remarkable in that respect as well as for its brilliancy. A method has also been adopted, we understand, for rendering Hofmann's violet soluble in water.

The cases of MM. Perrier and Cheppet Fils, and of the Fuchsine Company, are, especially the latter, exceedingly interesting and well arranged, and the more we admired them the more vexed we were to see no rivals to them in the English department, especially when we knew how easy it would have been for Perkin and Nicholson and Co. to have beaten them.

The question has often been asked us, "Did the Fuchsine Company ever bring out any colour of their own invention?" Perhaps some of your readers will be able to answer this.

The next case in order which we shall notice, is that of Messrs. Samuel Berger and Co., who display specimens of rice starch; but their case, which looks very dull, has only two dishes of starch and seven show cards in it, and therefore simply seems as a foil to the case of J. and J. Coleman, and Isaac Beckett and Sons. Both those firms gained medals in the English Exhibition of 1862. The starches of all these makers appear of the finest possible quality. Messrs. Coleman and Co., and Messrs. Beckett and Sons both show coloured starches of various shades. By means of these tinted starches muslins can be "got up" of any desired tint, and ladies can therefore have a muslin dress of a different colour every day, it being merely necessary to wash it and then stiffen with starch of the desired hue. We have been informed by those who have used them, that the results are all that can be desired.

Perhaps some of your readers may be unaware that starch can be dyed with the utmost facility, and without destroying the granules, by merely filtering a solution containing the desired colouring matter through a layer of the starch. When dried at a very moderate temperature, the so-called "starch lakes" are thus produced, and in brilliancy and soft beauty of tone they are perhaps unsurpassed. Unfortunately colours thus prepared have but little "body," and, what is perhaps worse, they are decidedly fugitive. Nevertheless for many purposes where a beautiful "mat" surface is required of velvety texture, they are very useful. Coloured confectionery may be cited as an instance where the starch lakes may be legitimately employed.

Messrs. Isaac Beckett and Sons have had the wisdom to display, side by side with the coloured starches, muslins of corresponding tint prepared by their use. We would recommend these gentlemen to renew the muslins, and also the coloured starches, at moderate intervals, as they will not stand many months of glaring daylight, without undergoing deterioration.

We are not with certainty aware of the nature of the dyes used by these firms for the purpose of colouring their starches, but all the coal tar colours are admirably adapted for the purpose, as the colour is almost entirely absorbed when cold aqueous solutions are filtered through a moderately thick layer of the starch.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON
SPECTRUM ANALYSIS,
WITH ITS APPLICATIONS TO ASTRONOMY.
By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

LECTURE III.

Solar spectrum.—Methods of observation.—Constituents of the solar atmosphere.—Spectra of the moon, and of the planets, comets, and meteors.—Inferences.

(Continued from page 11.)

I have now to explain to you how Kirchhoff has made these lines interpreters of the composition of the sun. When a series of electric sparks is made to pass between wires composed of any metal, the spark, when examined by the prism, exhibits the special spectrum of the metal. For instance, in this case we have two wires consisting of silver. If I cause this secondary current from an induction coil to pass in sparks through the interval of air between the two silver wires, particles of the metal will be detached in a gaseous condition, and they will give the special spectrum of silver. The heat produced in this way is most intense. Any other metal may be substituted for the silver, and may thus be made to yield its spectrum, the metallic points being placed in such a position that the light of the spark shall be reflected into the spectro-scope, and so into the eye of the observer.

I have already stated that it had been ascertained by Fraunhofer and other observers that a particular double black line, called D, in the sun's light, coincided with a bright line which was observed in certain flames, now known to be due to sodium. Kirchhoff, in order to ascertain the exact coincidence of the line D with the sodium lines, placed the light of the sodium so that the sun's light passed through it, and he found that, instead of getting the bright sodium line, he got a still more intensely dark line; he, in fact, discovered that the sodium line was reversed by the action of the more brilliant light of the sun, as already explained. But having found this in the case of sodium, he immediately began to examine other bodies in the same way, and he found that the lines of barium, strontium, and other metals were similarly reversed. He then began systematically to compare the bright spectra of the metals with the dark lines of the solar spectrum. When, for instance, iron is acted upon by the electric spark in the way I have described, it gives rise to a spectrum which contains some 70 bright lines in the space between the extreme red and the extreme violet. These bright lines differ very much in degrees of brightness: some are strong; some are weak; but the interesting point observed by Kirchhoff was not merely that for every bright line in the spectrum of iron there was a corresponding black line in the solar spectrum, but that they also corresponded in intensity. The brightest lines of the iron spectrum were the blackest in the sun's spectrum, and the feeblest in the iron spectrum were precisely the feeblest in that of the sun. This was a case not of the coincidence of two lines merely, which some persons might suppose to be an accident, but it was the coincidence of some 70 lines, line for line, and strength for strength. It is impossible to have a more striking proof of the identity of the cause by which these two effects were produced. Well, having ascertained in the case of iron that this coin-

cidence occurred, he proceeded to take other metals, and among them magnesium. This metal gives a very limited spectrum, consisting of a remarkable triple group in the green, and that group is found to coincide absolutely in strength and in position with the dark line marked *b* in the spectrum; for when this solar line is examined with care it is found to consist of three black lines, exactly corresponding in character with the three lines of magnesium. Magnesium in vapour, therefore, is one of the constituents of the atmosphere of the sun. So I might go on particularising the character of each metallic spectrum, but to save time I have enumerated in this list all the metals which are known to exist in the sun's atmosphere:—

Sodium.	Nickel.
Calcium.	Zinc.
Barium.	Strontium.
Magnesium.	Cadmium.
Iron.	Cobalt.
Chromium.	Hydrogen.

Copper might have been added, though its presence is rather doubtful. Others are also marked as doubtful. Though many of their lines correspond with dark solar lines, yet there are other lines produced by these metals which have no corresponding lines in the solar spectrum. That may arise from the circumstance that the proportion in which they occur in the sun's atmosphere is small. As a rule, the metals which are enumerated in the list furnish bright lines corresponding, line for line, with dark lines in the spectrum of the sun.

Now, this leads me to another important point. It will naturally be suggested to the mind, "It is very true that these are lines produced in the light which leaves the sun, before it gets to us; but how do we know that they are produced in the sun itself? All the substances of which we have seen lines in the solar spectrum are bodies which we know upon the earth. Is it not possible that all these bodies may exist in such quantities in the earth's atmosphere that they may be the means of shutting out these rays of light which are found to be deficient in the sun's rays when they reach us?" That is, certainly, an important question; but it can be answered perfectly. If we had only the light of the sun to judge from, it might be a difficult point to decide; but we have in the stars a multitude of other bodies from which we derive light quite independent of that of the sun. If we found that every star gave us the same spectrum as the sun, then we might well question whether these lines were really due to matters existing in the sun, or whether they were not due to bodies in the earth's atmosphere. But, as we shall see in the next lecture, every star gives a spectrum of *its own*. Now the light which comes from the stars ought to be acted upon exactly in the same way as the light of the sun, if the cause of the lines were in the atmosphere of the earth. We find it is not so. The cause, therefore, does not reside in the atmosphere of the earth,—at least in the majority of cases; although, as I shall show you presently, there are certain lines truly due to the action of the earth's atmosphere.

Spectrum analysis cannot tell us whether the visible surface of the sun is solid or liquid, or whether it is made up of cloud; because either a cloud, or a liquid, or a solid body would give us a continuous spectrum. If we took the light emitted by phosphoric acid, produced in burning phosphorus in oxygen, it would give us a continuous spectrum just as the surface of the sun does. But we know that there is a great atmosphere outside the visible disc of the sun which is revealed to us temporarily during a total eclipse. That great atmosphere contains bodies of all sorts in a state of vapour, volatilised by the enormous heat which is produced in the sun itself. Of course the farther this extends from the sun the colder it must be, and therefore there must be a point in the sun's atmosphere in which we are precisely in the position required to give this reversal of the bright lines due to each metallic vapour; that is to say, we must have an

intensely heated nucleus behind a colder atmosphere; but even this colder atmosphere may be so intensely heated as to keep all these bodies which we cannot even volatilise in our furnaces, in a state of vapour: if so they must give us the dark lines observed in the solar spectrum, by absorbing, from the light of the incandescent nucleus of the sun, vibrations of the particular frequency corresponding with those produced by the metallic vapours themselves. Thus, in the light which comes to us, we have proof from the absent vibrations. We have, I say, a proof of the existence of these atmospheric bodies in the sun which arrest the corresponding vibrations produced behind them. That is the proof which Kirchhoff has given us of the presence of these bodies in the sun.

I stated just now that there are lines produced by the earth's atmosphere. This is a curious observation. It was first made by Sir David Brewster, and he arrived at the fact in this way. Here is a diagram, which may help to make it plain. Suppose this part to represent the globe of the earth, and here is an exaggerated representation of the atmosphere. You can see easily that if the sun were nearly vertical, the light would traverse a much smaller portion of the atmosphere than it would when its beams are nearly horizontal, near sunrise or sunset. The sun's light would then have to traverse a portion of the atmosphere nearer the earth, and greater in density than that through which the light would pass when the sun was high up; so that if the spectra are different when the sun is in these two different positions, we might then say that it is probable that this effect is due to something in the atmosphere of the earth itself. Sometimes opportunities of proving this occur accidentally. I have had myself such an opportunity. I was one day looking at the spectrum when a thunder-shower came on; suddenly there started into view a group of new lines, evidently produced by some sudden change in the air at the moment. The storm shortly after subsided, and the changes which had occurred in the spectrum vanished. M. Janssen, a distinguished French experimentalist, and Prof. Cooke, an American man of science, have both made observations which show that variations in the amount of moisture in the air are connected with changes of this kind. The experiments which M. Janssen made were of this kind. On the border of the lake of Geneva, he caused a pile of wood to be lighted on the top of a mountain. Having stationed himself on the other side of the lake, about thirteen miles off, he viewed this fire through a spectroscope, across the body of moist air resting upon the lake, taking care to have it at the same time observed near at hand, where a continuous spectrum only was seen. In this way he detected the presence of certain lines in the less refrangible end, occasioned by moisture contained in the atmosphere. He afterwards performed another ingenious experiment, which I regret that I cannot show in this theatre. He took an iron tube, of about 37 metres, that is, about 40 yards, in length, closed by plates of glass at the extremities. At one end he placed a gas flame, and then looked through the tube at the spectrum of the flame, by means of a spectroscope, and thus obtained a continuous spectrum. He then injected into the tube some steam, at a pressure of 7 or 8 atmospheres, so that he got a dense body of aqueous vapour. Then, on looking through the tube at the flame by means of the spectroscope, he saw in the red part of the spectrum, lines, something like those which are seen in the diagram,—strong bands of lines, evidently produced by the absorptive action of the aqueous vapour in the tube. The temperature and the pressure of the vapour were high, but they had nothing to do with the production of the lines; they were merely used as a means of getting a large mass of vapour into a small space.

In the application of this observation we have a number of curious and very interesting facts. You will remember that the solar light has this remarkable feature,—and, indeed, all lights are the same in that respect,—that whether it is seen directly, or whether it is reflected from a clean white surface, it still betrays its origin; that is to say, it

always shows the same lines. If we were to look at the spectrum obtained from the sun's light direct, and then look at the spectrum of the same light after reflection from the surface of a cloud or from a mirror, we should find that the position and number of the lines were just the same in both instances. In the reflected light we should not have so intense a spectrum, but the lines would be in just the same places as in the direct light, and we should know for certain that the light in either case came from the surface of the sun.

Now, what is true in this case appears to be true in all cases of reflection. It is true, for instance, in the case of reflection from the moon. I will throw upon the screen a representation of the moon, as it appears from one of Mr. De la Rue's recent photographs of the moon. What I want to call your attention to is this, that we have in the spectroscope the means of travelling over the surface of the moon, and examining the quality of light reflected from its different parts. Now, what use can we make of this? Suppose we wish to examine whether the moon has an atmosphere. We find, by the telescope, that we can see right down to the surface of the moon. The parts of its face are never obscured by clouds or by dark vapours connected with the moon itself. But it might yet happen that a delicate atmosphere, containing a very small quantity of vapour, existed round the moon, and the thickness of this stratum would necessarily vary when viewed at different parts of the surface. If we looked at the edge of the moon, the effect would be similar to that produced by viewing the sun near the horizon, the light which was transmitted from the edge would come through a long column of this atmosphere before it reached us. If we looked direct at the centre of the disc, where the light would have to traverse a smaller depth of atmosphere than at any other point, we ought, if there were any atmosphere containing absorbent vapours, to observe a difference between that light and the light at the moon's edge. Now, on looking at these different portions of the moon, we find that the light comes from all parts, without any change. Hence we must conclude that if there is an atmosphere around the moon, it must be so excessively dilute that it cannot produce any absorptive change in the light which is perceptible in its spectrum.

Again: we can apply these observations to show that the moon does not shine of its own light, though we do not need the proof of that fact from this source; and we may also apply the same proof to all the planetary bodies. But though we already know that the moon and the planets shine by reflected light, in other instances the knowledge we can thus derive may be of importance to us. Take, for example, the case of a comet; does that shine by direct or reflected light? I will show you how this question may be answered. But, before doing so, it will be desirable to consider the result obtained by observations upon Jupiter,—a body which certainly shines by reflected light. And here we acquire some information regarding the atmosphere which surrounds Jupiter, because the light reflected from Jupiter is not identical with the light which falls upon it. Here is a diagram of some observations made at Tulse Hill, by Mr. Huggins and myself, which may make this clear. The spectrum of Jupiter's light shows us, in particular, a dark band in the orange. Besides the ordinary solar lines, which are very well seen in the case of Jupiter's light, there are groups of lines connected with the atmosphere of the planet. The object was to see whether the spectrum produced by Jupiter was different from that of the earth's atmosphere; and this object was attained by comparing the light of the planet with that of the sky, which was at that time reflecting the light of the setting sun, under circumstances in which a reflected spectrum from the surface of the sky itself was not too intense for comparison with the spectrum of Jupiter. These are some photographs of drawings of the appearance of Jupiter, made some years ago by Mr. Huggins, from telescopic

observations. Astronomers have long believed that an atmosphere of considerable density exists around this planet. These bands or belts are produced, it is supposed, in consequence of clouds accumulating near its equator. They show us that, in all probability, the atmosphere of Jupiter is largely charged with aqueous vapour, and that the surface of the planet itself is not actually seen. Consequently, the light which we see reflected by the planet does not come from the body of Jupiter itself; it penetrates to a certain depth, and then comes back, after traversing a portion of its atmosphere; and therefore we do not know what is the actual condition of its surface. In Saturn and Mars we also obtain, by means of the spectrum, a certain amount of knowledge of the state of things upon both those planets. In the spectrum of Mars a number of bands in the blue make their appearance. It has been supposed that the red colour of Mars was produced by a peculiar colour of the soil. These spectrum observations seem to show that it is due rather to something in the atmosphere, and not to anything in the soil; because, if it were the latter, we should merely have a blotting out of the spectrum, and there would not be a series of regular bands, which have been observed in the case of Mars.

I have stated that by the method of spectrum observation we may ascertain whether comets are self-luminous, and may even attain to some knowledge of their composition. Our knowledge of the spectra of comets is, indeed, excessively limited. Donati, in 1864, made some observations; but the results he obtained were not very definite. I believe that those of Mr. Huggins, upon the small telescopic comet of 1866, are the best at present existing. It had a bright central nucleus, and around that was a nebulous atmosphere, not prolonged into a tail, as is usual in most comets. By means which I must explain in the next lecture, the spectroscopic was brought to bear upon it, when it was found that the coma, or tail, gave a prolonged continuous spectrum, and in the middle of that spectrum there was a spot of bright greenish blue colour, indicating the position of the nucleus. What information does this give? It appears to show that the spectrum of the coma is produced by reflected light, and that the tail of the comet is somewhat in the position of a fog; that that fog reflects from the sun light of all colours, whilst the central portion is giving out light of its own, and light of one colour only. However, I have not time to-day to go into that point. I shall take it up again in connection with those remarkable bodies, the nebulae, with which I shall deal in the next lecture.

ACADEMY OF SCIENCES.

JULY 1, 1867.

(FROM OUR OWN CORRESPONDENT.)

New Volcanic Islands.—Works of Lagrange.—Sir D. Brewster on Lighthouses.—Aniline Colours on Cotton.

M. CHEVREUL, president, opened the meeting, and in the absence of the perpetual secretary read the correspondence, minutes, &c.

M. C. St. Claire Deville handed in a note inserted in a Portuguese journal, the *Perseverancia*, announcing that between Tersira and Graciosa, two islands near Lisbon, have been subjected to continual volcanic eruptions; very strong shocks of earthquakes have been felt, and have produced many islets, one after the other, analogous to those of Santorin in Greece. On the 1st June a submarine volcano cast up igneous matters in such quantity, that a tongue of land has been formed with the continent. This ground is as yet unapproachable, on account of the incandescence of the rocks, as well as the sulphurous vapours from the fissures. M. Deville asked that the Academy should take an interest in these new eruptions, as it did in those of Santorin.

M. Treuil read a note on the lactiferous vessels of fig-trees and euphorbiaceae.

M. Serret presented to the Academy the first volume of the works of Lagrange, which were published under his direction by order of the Minister of Public Works. This great work consists of eight volumes of 1,800 pages each, with plates, and will be distributed to each member of the academy. They contain papers on mathematics, chemistry, physics, anatomy, hydraulics, &c.

Sir David Brewster sent a very interesting memoir on the history of light-houses and dioptric apparatus.

M. Morris sent a copy of his book on wine making, &c.

M. Fournet, of Lyons, sent a great memoir on atmospheric electricity.

M. Chevreul read a note from M. Biddeman, at Berlin, on aniline colours for cotton.

The meeting then resolved itself into a secret committee to elect a member in place of M. Pelouze, deceased, MM. Cahours, Berthelot, and Wurtz are proposed; M. Wurtz will most likely succeed to the vacant chair.

JULY 9, 1867.

Practical Meteorology.—Letters from Rotrou to Cardinal Richelieu—Alleged Discovery of the Law of Gravitation by Pascal, prior to Newton—E. Becquerel on Capillary Chemistry—Researches on Benzol and its Derivatives—Cause of Tubercular Disease—Daubree on the Classification of Meteoric Stones—Theory of Volcanic Upheavals—Telescopic Views of the Great Nebula in Orion—Election of Adolphe Wurtz, F.R.S., to the Academician's Chair, vacant by the Death of Pelouze.

M. Chapelas-Coulvier-Gravier presented to the Academy a small volume which he published under the title of "Practical Meteorology."

M. Chasles presented to the Academy two letters from the poet Rotrou to Cardinal Richelieu. In the first, Rotrou advises the celebrated minister to found, in Paris, a literary society analogous to that of the floral games of Toulouse; in the second he thanks him for having seriously entertained the proposition by founding the French Academy. To these presents M. Chasles added two other letters, one from Rotrou to Corneille, and another from Corneille to Rotrou. M. Chevreul reminded M. Chasles that he told him one day that he (the latter) was in possession of two autograph letters, from which it resulted that Pascal had discovered and calculated, before Newton, the law of universal gravitation of masses in the inverse ratio of the square of the distance. Pascal was born in 1623, died in 1662, and Newton only made his great discovery in 1665. If it is true that, in documents written by his hand, Pascal had established the law of gravitation, it is certain that he was in advance of Newton. The documents M. Chasles possesses are: the first, a letter written by Pascal to Robert Boyle, the illustrious physician; the other is a note certainly written by his own hand. M. Chasles promised to bring to the Academy, on Monday next, the two precious documents, and to make them the subject of a more explicit communication.

M. Becquerel, sen., read a third communication on capillary chemistry. He pointed out new facts of chemical decompositions taking place under the influence of capillarity, and he thought he has proved that these truly curious phenomena were produced under the triple influence of affinity, capillarity, and electricity. To demonstrate the intervention of electricity, M. Becquerel has made the following experiment: he immersed his split bell-glass, containing nitrate of copper, in a second bell containing a solution of monosulphide, as in the first experiments; then he dips the two extremities of a silver wire, one into the nitrate and the other into the monosulphide. A constant electric current is formed: 1. The deposit of silver is made not in the capillary slit, but on the iron; 2. When the wire is removed the deposit is formed in the slit and on the edges along the side of the split bell glass. The capillary action is as powerful as an electrical action. M. Becquerel continues to improve his experiments; for the split bell-glass he substitutes prisms of crystal glass pierced with a small hole; the slit or fissure is replaced by plates of glass with edges in contact, or even by sand; and he has thus obtained effects of silvering, gilding, platinising,

and very remarkable deposits of gold, silver, nickel and cobalt.

M. Zinin, of the Academy of Sciences of St. Petersburg, read a *resume* on his researches on benzol and its derivatives, azobenzol, azoxybenzol, &c.

M. Velpéau read a letter in which M. Lebert, of Breslau, states that he thinks he has found the cause of tubercular disease in the shortening of the pulmonary artery.

M. Daubrée enumerated the bases of the classification and methodical arrangement of the collection of meteoric stones and iron of the Museum of Natural History.

M. Edmond Becquerel communicated an observation, of M. Janssen, from which it results that the oscillatory motions of volcanic upheavings are always perpendicular to the faults that can be compared to an opening, the edges of which open and shut by turns.

Father Secchi, of Rome, handed in two telescopic views of the nebula in Orion, made in 1859 and 1865.

The Academy then formed into a committee for the discussion of the claims of the candidates for the chair in the chemical section, rendered vacant by the death of M. Pelouze. The section presented in the first place M. Wurtz, and secondly in alphabetical order, M. Berthelot, and M. Cahours. M. Wurtz, the discoverer of glycol, and compound ammonias, is most likely to be elected unanimously. The discovery of glycol and compound ammonias gained for him the prize of £400. His "Chemical Philosophy" has been translated into many languages—into English by Mr. Crookes, &c.; his claims are of the first order, even in the presence of the innumerable discoveries of M. Berthelot, and the long and glorious labours of M. Cahours.

NOTICES OF BOOKS.

The Alkali Act, 1863. Third Annual Report by the Inspector, of his Proceedings during the Year 1866.
By DR. ANGUS SMITH, F.R.S., &c., Government Inspector.

It is gratifying to find that Dr. Angus Smith is able to state in this, his third report, that there has been a further advance in the manner of preventing the escape of muriatic acid gas; and that, although during the last year the escape has been greater in the actual number of tons, it is owing to the increase in the manufacture. The amount of salt decomposed during the first year of inspection was 288,000 tons, during the second 310,000, and during the third it is 371,950. The necessity for inspection is well borne out by many of the facts related in connection with them.

For instance, in one case, where there appeared to be all the ordinary contrivances for condensation, 20·5 per cent of the muriatic acid was found to be escaping. Another test, taken after alterations had been made, with a view of checking the escape, showed the presence of 13·5 per cent. The owner was prohibited from working with these arrangements. He stopped work, and erected a second condensing tower, but the escape was still 15 per cent. The inspector again prohibited work until a remedy was found. The arrangements ultimately were properly made, and at a subsequent inspection the escape was only 1 per cent. Dr. Angus Smith writes—"The struggle with the condensers may be said to have ceased; the circumstances are understood. Our new struggle is with this escape from the works, and of a certain amount of gas which passes through bricks, tubes, and even stone, as well as of that coming occasionally from the mouth of the furnace."

The author remarks upon the way in which the manufacturers have come to regard inspectors. Finding that in many manufactories there was not a sufficient staff with chemical knowledge, the inspector has given advice with regard to the alterations required, and if the changes have been speedily made, has refrained from prosecution. A letter from a manufacturer illustrates the feeling

referred to. In the course of it he writes: "It is very annoying to me that you should ever find anything to find fault with, but as our method of working is uniformly the same, and as we have no means of knowing when the condensation is right except from your tests and inspections, I hope you will not be long before you come again, and, if possible, often." The author of the report says: "I consider this letter an indication that the time has now come for throwing aside much of the responsibility which we have taken from the manufacturers, or they will turn round to throw on us the blame of any infraction of the Act committed in their own works." It would appear that the proprietor found that in the visits of the inspector he obtained such valuable advice as to save him the expense of attaching a chemist to his establishment. No doubt great good has been done by the excellent spirit in which the inspections have been made, but now that manufacturers are making greater profits by the larger amount of acid they are enabled to obtain from the same amount of material, and likewise by the saving, in many cases, of the amounts formerly paid as damages, we consider that Dr. Angus Smith, and those gentlemen under his direction, have no longer any need to burden themselves with duties which, as inspectors, they were in no way bound to undertake. The author is evidently not inclined to a radical change in this direction, as the following extract in reference to the peremptory demand of good condensation shows:—"When the habit of condensing or of destroying all noxious vapours has been longer confirmed, this demand may grow to be just and reasonable." In another place he remarks that if the number of works under the inspectors were much increased, there would be no time left in which to consider and advise manufacturers. At the end of the report are a few pages devoted to the consideration of what is meant by a nuisance.

Dr. Angus Smith shows, we think very clearly, an advantage of inspection. This, although a minor one, is of great importance to manufacturers, as they possess one interest, and the public another. It is in reference to the subject of a nuisance—a word conveying an excessively vague meaning—that the author draws attention. At present, he says, excepting those factories coming under the Alkali Act, the public are not protected from the manufacturer, neither is the latter protected from the public. Take, in the first place, the case of a householder who suffers from the escape of noxious gases evolved from a nest, such as in London is found at Belle Isle. The processes, which may be bad enough when properly carried on, are probably clumsily managed. He must of course be able to fix the nuisance upon a particular factory, and this is one great difficulty. In such cases the evidence is characterised by great uncertainty; even a chemist, as Dr. Angus Smith says, is frequently obliged to trust chiefly to his senses, as he cannot obtain admission to the factory, and therefore the gases may be so diluted where he examines the air as to make it difficult to prove their presence. The following sentence, occurring in the report, exactly expresses our own opinion upon this point:—

"The want of protection to the public lies, in ordinary nuisance cases, in the want of power to enter the works and to make experiments."

In another place the author writes, "Unless chemists can define a nuisance, and have opportunity of examining in cases of complaint, neither the public nor the manufacturer is protected."

Taking now the case of a manufacturer, a case is stated showing that he is liable to be attacked and injured unjustly:—

"It sometimes happens," as the author puts it, "that a neighbour who is peculiarly sensitive, objects to the smell of even well-conducted works; he may be able to say truly that they are to him very offensive, and he may have no idea that, were all men to have an equally acute sense of smell, manufactures would cease. He may, however, care little for such things, and be determined to seek

his own comfort only, and he, therefore, on oath and with truth, says that the smell makes his house unpleasant."

The laws referring to nuisances, we are told, are also vague, owing to the want of precise modes of detecting them.

This is not the case with those which come under the Alkali Act. Here there is complete protection up to a certain point, to both manufacturers and the public. We quote once more to give the opinion of the author, who is necessarily an authority, upon this point. He says:—"It seems to me that the system of inspection protects both sides if the inspector has his direct instructions, as under the Alkali Act, to look for the condensation of a distinct amount. The public is freed from 95 per cent, of muriatic acid by this Act, and the manufacturer is protected from the complaints of the public so far. If a similar fixed point could be adopted in the case of every gas, there would be complete protection to the public and manufacturer on both sides up to that point, occasional mistakes and accidents excepted. It seems to me a most important thing to seek such fixed points, and where they cannot be attained to make the nearest approach to them, so that evidence may be taken by competent persons on the spot, instead of by persons stretching at some distance beyond the works the capacities of their sense of smell."

The Act referring to the manufacture of hydrochloric acid has worked so well that we would urge upon the Government the necessity of the inspection of all similar manufactures. There can be little question that that the Alkali Act has resulted in benefit to the manufacturers who were brought under its influence. Imagine a manufacturer of hydrochloric acid (we are willing to believe it an exceptional case) allowing an escape of 20 per cent!

In an appendix Dr. Angus Smith describes an apparatus, and the method of using it, for the determination of the speed of air in flues. We must refer those of our readers who may be interested to the original, as the paper is long, and not capable of condensation.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Phenol-group, Contributions to the history of.—L. Dussart. ($\text{C} = 12, \text{O} = 16$). Naphthalene, on being heated with sulphuric acid (10 parts of the former to 25 of the latter), is completely converted into sulpho-naphthalic acid, which, on continued heating, changes into disulpho-naphthalic acid. If pure naphthalene has been taken, little sulphurous acid is formed. The salts of disulpho-naphthalic acid are decomposed by fusing potassic hydrate under formation of a new body, the analysis of which led to the formula of the diatomic phenol $\text{C}_{10}\text{H}_8\text{O}_2$. This body is more soluble in water than naphthol; it dissolves readily in caustic potash, which solution is instantaneously decomposed on exposure to air.—(*Comptes*, R. lxiv. 859).

Benzoin, derivatives of ($\text{C} = 12, \text{O} = 16$).—M. Zinin. If benzoin is heated with fuming chlorhydric acid to 130°C . under pressure, an oily body is formed, which on cooling solidifies to a crystalline mass. Of this mass about 72 per cent are soluble in ether or alcohol, and this solution, on evaporation, yields crystals of benzil, and a thick yellow oil, insoluble in water, easily soluble in alcohol and ether. The portion insoluble in ether is a new compound which the author calls lepidin, its composition is $\text{C}_{28}\text{H}_{20}\text{O}$. It is insoluble in water, readily soluble in benzol. It melts at 175° , and evaporates at 220° . Potassic hydrate, either solid or in alcoholic solution, does not act upon lepidin. Nitric acid and chromic acid convert it into crystalline oxy-lepidin $\text{C}_{28}\text{H}_{20}\text{O}_2$, which is insoluble in water, nearly so in ether, readily soluble in benzol. Its melting point is 220° . Zinc and acetic acid reduce it again to lepidin. A bromine substitution compound of lepidin, $\text{C}_{28}\text{H}_{18}\text{Br}_2\text{O}$, has been ob-

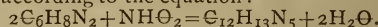
tained by adding bromine to its solution in acetic acid.—*Acad. Petersb.* xi. 151).

Platinic and Auric Chlorides, Combinations of.—Weber. ($\text{O} = 8$). The yellow crystals which are obtained on adding fuming nitric acid to a solution of platinic chloride have the composition $\text{PtCl}_4 + \text{NO}_2\text{Cl} + \text{HO}$. They dissolve in water with disengagement of NO_2 . From a solution of platinic chloride in chlorhydric acid (free from nitric), red brown crystals separate on evaporation under the dessicator, which have the composition of Marignac's double chloride of platinum and sodium, but containing H in place of Na.,— $\text{PtCl}_2 + \text{ClH} + 6\text{HO}$. A similar compound has been obtained with auric chloride $\text{AuCl}_3 + \text{HCl} + 6\text{HO}$.—(*Acad. Berl.*, Feb., 1867).

Action of Chloride of Sulphur on Metals and Sulphides—($\text{S} = 16$).—E. Baudrimont has studied the action of sulphurous chloride (S_2Cl_2) on various metals and sulphides. The reaction in which metallic chloride is formed, and sulphur precipitated, takes place most readily with those metals, the chlorides of which are volatile, but is prevented altogether in the case of magnesium and sodium.—(*Comptes*. R. lxiv., 368).

Benzyllic, bromide, and bromtoluol.—F. Beilstein. The action of bromine on toluol is analogous to that of chlorine on toluol. Benzyllic bromide (not free from bromtoluol) is obtained when vapours of bromine are made to act upon boiling toluol, and bromtoluol (free from benzyllic bromide), when bromine in presence of sodium acts on toluol, either cold or hot.—(*Zeitschr. Chem.* N.F., iii. 281r).

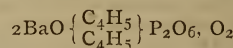
Phenylene brown.—Caro and Griess ($\text{C} = 12$). Experiments of Hofmann, Martius, and Holle, have shown that β phenylene-diamine on being acted upon by nitrous acid is decomposed with formation of a brown substance, which under favourable conditions may be obtained as a crystalline body of basic nature. If to a cold, dilute, neutral solution of phenylene-diaminic chlorhydrate is added a neutral solution of a nitrite, a crystalline dark-red mass is precipitated. Washed with water and treated with strong chlorhydric acid, it first dissolves and then the chlorhydrate of the new base separates as a tarry liquor. The latter decomposed in aqueous solution by ammonia, yields the dye in a crystalline state. The phenylene-brown consists chiefly of a new base of the composition $\text{C}_{12}\text{H}_{13}\text{N}_5$, and is derived from β -phenylene-diamine according to the equation:



Its constitution is considered to be $\text{C}_{12}\text{H}_7(\text{NH}_2)_3\text{N}_2$, that is, triamidoazobenzol.—(*Zeitschr. Chem.* N.F., iii. 278.)

Crystalline Chromic Oxide.—R. Otto has obtained chromic oxide in the crystalline state, by passing a current of hydrogen over potassic bichromate. The salt is reduced to potassic chromate, which serves as the medium in which the oxide crystallises.—(*Ann. Chem. Pharm.*, cxlii. 102.)

Ethyl-pyrophosphoric Acid.—G. Dilling ($\text{C} = 6, \text{O} = 8$). Phosphoric anhydride at ordinary temperature does not act upon zinc ethide; heated together in sealed tubes to 140°C . ethyl-pyrophosphate is formed, besides other products. The basic salt of this acid has the composition,



Ethyl-pyrophosphoric acid may be considered as a derivative of pyrophosphoric acid in which one or two atoms of oxygen are replaced by ethyl.—(*Zeitschr. Chem.*, N.F. iii. 266.)

Creosote.—E. Probst, in a preliminary communication states that he has obtained pyrocatechin from beech-wood-creosote by melting the latter with an excess of potassic hydrate. He reserves to himself a more complete investigation of this subject.—(*Zeitschr. Chem.*, N. F. iii. 280.)

Gallic, Pyrogallic, and Oxyphenic Acids, Bromo-derivatives of.—H. Hlasiwetz ($\text{C} = 12, \text{O} = 16$). These three acids combine readily with bromine, forming the following substitution-compounds:—Bromogallic acid,

$C_7H_4Br_2O_3$, readily soluble in hot water, in which solution ferric chloride produces a brilliant violet, ammonia a red coloration. Bromopyrogallallic acid, $C_6H_3Br_3O_3$, is somewhat less soluble in water, but gives the same reactions as the former. Bromoxyphenic acid, $C_6H_2Br_4O_3$, is insoluble in water, readily soluble in dilute alcohol; its solution assumes a dark blue colour on addition of ferric chloride.—(*Acad. Wien.*, 55, 1867.)

Titanic Iodide.—P. Hautefeuille. This compound is readily obtained by acting upon titanic chloride with hydriodic acid. When purified by repeated sublimation in a current of hydrogen it forms a brittle red-brown mass, which fuses at $150^\circ C$, and crystallises on cooling. It boils above 360° , and its vapour density, taken at 440° , was found = 18.054; calculated for 2 volumes, it should be 19.334. It is soluble in water, but the solution soon decomposes with precipitation of titanic acid.—(*Bull. Soc. Chim.*, vii. 201.)

Chloric Acid, determination of.—C. Stelling ($O=8$). Potassic chlorate is reduced to chloride on being treated with ferrous oxide, according to the equation, $KOClO_3 + 12FeO = KCl + 6Fe_2O_3$. This suggested the following method for the determination of chloric acid:—To a solution of the chlorate is added ferrous sulphate and an excess of potassic hydrate; the mixture is boiled and filtered, and in the filtrate the chlorine determined in the usual manner.—(*Zeitschr. Analyt. Chem.*, vi. 32.)

Cobalt and Nickel, Atomic Weights of.—Cl. Winkler has determined the atomic weight of these metals according to the following method:—The metals were prepared in a state of perfect purity; the cobalt, by reduction of repeatedly recrystallised purpureo-cobaltic chloride in a current of hydrogen at a high temperature. The nickel, by adding to a solution of the commercial carbonate in chlorhydric acid sodic hypochlorite, and treating the liquid in this manner again so long as any cobalt could be detected in it; the solution was then purified from traces of copper and arsenic and precipitated with sodic carbonate. The carbonate was converted into chloride, and sublimed in a current of chlorine, and lastly reduced in a current of hydrogen.

Weighed quantities of the metals were then immersed in a perfectly neutral, concentrated, cold solution of sodio-aucric chloride, and the weight of the precipitated gold determined. The mean of five experiments with cobalt gave the number 29.496. The mean of four with nickel, the number 29.527.

The atomic weights of these metals may therefore be taken as identical, i.e., 29.5.—(*Zeit. Analyt., Ch.*, vi. 18.)

CORRESPONDENCE.

USE OF DISTILLED WATER.

To the Editor of the Chemical News.

SIR,—In Mr. Quin's report upon the Paris Exhibition, reference is made to the use of distilled water at the Wallaro Copper Mines in South Australia, stating that until tanks for collecting rain-water had been constructed, "perhaps for the first time in the history of the world, there was a population of some thousands, with all their horses, cattle, sheep, &c., drinking *aqua distillata*." As many of your readers may not be aware of the fact, it may be interesting here to mention that in the rainless region of the Pacific coast of South America, the entire population of the country, between about the 18th and 28th parallels of south latitude, or some 600 miles from south to north, including the important towns of Caldera, Cobija, Iquique, Pisagua, and several minor ports, have for many years derived their supply of potable water from the sea water of the Pacific, distilled in greater part by coal imported from England, and costing above £3 per ton.

Not only is a population of many thousand inhabitants principally engaged in the mines of this district, as well as a still larger number of beasts of burden, and other animals, supplied from this source, but even the locomotives

on the Copiapo and Caldera railway, and some steam engines for other purposes, are actually driven with distilled water. For a distance of some thirty to fifty miles inland from the coast, very few natural springs are met with in this rainless desert, and when met with they are seldom sufficiently free from saline matter to be potable.

D. F.

MISCELLANEOUS.

On the Manufacture of Zinc.—C. Trainer. Comparison of the Belgian and Silesian distilling furnace gives the following result. The Belgian furnaces with some 60 effective retorts in 7 to 8 horizontal rows require less fuel, the process is more intense, is finished sooner, and yields more. However, they require a full-flaming coal, and the consumption of retorts is greater; and when breakages occur the under retorts often suffer. The attention to these furnaces requires very intelligent and experienced workmen, as they have to keep up an equal temperature of all the retorts, above and below, front and back. On the other hand, the Silesian furnaces require less skilful workmen, and less vessels, as they last longer, while the consumption of fuel is larger, but a less open burning coal may be used. The latest improvements in the Silesian furnaces for the purpose of saving fuel (two rows of muffles above each other, and a downward flame) require a free burning coal as well as more expert workmen. A greater durability is ascribed to the Silesian furnaces than to the Belgian; this advantage, however, is doubtful after having introduced considerably improved arrangements in the front wall of the Belgian furnaces. Such improved furnaces lasted two years, at an average, near Iserlohn. It is advantageous to the durability of the furnaces for them always to be attended by the same workmen. The Silesian process extracts more zinc from the ores on account of their longer stay in the furnace and the less amount of breakage of the distilling vessels, whilst the Belgian furnaces have, for a fixed time, greater productiveness. When the ore forms tough slags the Silesian method is preferable. Trials of zinc-melting in blast-furnaces have not been successful. It would lead to considerable advantage if the distillation of the zinc-ore could be effected in a large flat muffle, which could be sufficiently heated and would not crack. Such an apparatus, on the one side with openings for charging, on the other with vessels for condensation, would require a less amount of fuel.—*Berg. und Huttmt. Zeitung* 1867, No. 24.

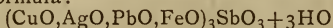
Mercerising Cotton.—To Mr. Mercer must be attributed the discovery of the peculiar action of caustic, soda, and sulphuric acid upon cotton. This singular process, now called "mercerising" has the effect of untwisting the normally twisted flattened tubes of cotton filaments and converting them into cylindrical tubes. When colours are applied to the cotton so treated, they pass more readily through the minute pores of the tubes and are precipitated in denser layers in the interior of the latter, whereby darker and more permanent shades are produced. Calico so treated become greatly increased in strength, and though hitherto no large quantities of cloth thus prepared have been printed, owing to the expense of preparation, advantage has been taken of the process to prepare the cotton fabric used in the production of the endless web known to calico printers as the india rubber blanket, which, when made with prepared calico, is rendered much more durable.—*Proc. Lit. Phil. Soc., Manchester*.

Determination of Bismuth in Lead Alloys.—(Patera). The alloys are dissolved in nitric acid, the solution diluted with water, and the bismuth precipitated by a strip of pure lead. The precipitated bismuth, black of colour and in the state of powder, is quickly washed off the lead, the solution of lead is decanted; the bismuth is then washed first with water and then with alcohol, filtered on a weighed filter, dried and weighed.—*Berggeist*, 1867, No. 28.

Blasting with Sodium.—Experiments are now being made, in the Isle of Man and elsewhere, to ascertain the value of sodium, in contact with water and other substances, for blasting purposes.—*British Journal of Photography*.

An Old Anæsthetic Revived.—An enterprising American dentist advertises that he now takes teeth out painlessly by merely causing the patient to inhale the constituents of the atmosphere—oxygen and hydrogen—chemically combined.

Partzite.—This mineral, discovered by Dr. Part in 1865, has been investigated by Albert Arents. It occurs in amorphous masses, generally without lustre. Fracture, varies from conchoidal to even; colour, yellowish green to blackish green and black; sp. gr. = 3·8; hardness, 3·4. Before the blowpipe on platinum it is melted, but with difficulty, to a black slag; on charcoal, especially with addition of carbonate of soda and powdered charcoal, a metallic button is easily obtained much resembling pure antimony. Sulphuric, nitric, or hydrochloric acid decomposes the mineral. An analysis gave number corresponding to the formula:



Partzite occurs with argentiferous galena.—*Silliman's Journal*, May 1867.

Action of Water upon Carbohydrates at an Elevated Temperature.—O. Loew. Cane sugar at 160°C. yields levulose and glucose; at 180°C. caramel; at 200°C. caramel, assamar, and carmelin; and at about 250°C. is totally decomposed. The author finds that the presence of water makes a great difference. Sugar is perfectly decomposed when heated with water in a sealed tube to 160°, the water seeming to act as an acid. Sugar heated with alcohol in a sealed tube to the same temperature remains unaltered. Sugar heated with baryta water in tubes is not decomposed at 170°C. Water acts in the same way upon other "carbohydrates." Starch, gum, and milk sugar with water are decomposed by five hours' heating at 70°C. The products are formic acid, carbon, and carbonic acid.—*Silliman's Journal*, May, 1867.

A Catastrophe Averted.—In the course of last winter the river Irwell rose nearly twenty feet above its ordinary level, and flooded the works of the Magnesium Metal Company on the Salford side to a depth of about seven feet in every part. There were then from three to four hundred-weight of sodium in stock, and, soon after the commencement of the flood, the room in which the sodium was stored was two feet deep in water; but, as it rained in torrents, it was then considered best not to run the risk of attempting to move it off the premises. The sodium was stored in long narrow jars, with loosely-fitting covers, made air-tight by allowing the bottoms of the lids to rest in a circular groove filled with oil. As the flood did not abate, and the position began to grow more dangerous, one of the men volunteered to go on the roof of the sodium shed and watch the water rise, and for hours he lay upon the roof in a soaking shower of rain, watching the sodium jars. Inch by inch the water rose, and at last, when it was only half a foot from the top of the jars, he drew his head out of the hole in the roof where it had been sticking so long and summoned the rest of the men. They unslated the roof of the store room, let themselves down into the water, now reaching nearly to their armpits, and removed the sodium lump by lump into other vessels placed among the rafters of the roof. By accident one little ingot of sodium fell into the water, causing the courage of the men to falter; but the lump fortunately only fumed and fizzed, and dissolved away without exploding. After the flood was over the Magnesium Metal Company built a platform near the roof, on which all sodium is now stored. We have not heard what bonus the Company voted to the men who removed the sodium, especially to the one who stuck to the top of the roof like a limpet to a rock in a storm, but doubtless it was something handsome.—*British Journal of Photography*.

NOTES AND QUERIES.

Chemical Calculus.—Sir,—Allow me to point out a correction which it would be desirable to make in your otherwise excellent abstract of my note at the Royal Society on the "Chemical Calculus." In the abstract my translation of Brodie's formula for hydrochloric acid, is given thus:—



instead of thus—



And in like manner the line which I employ between the numerator and denominator of other symbols in the form of division is omitted. My intention was to use the symbol of division to denote decomposition, just as the symbol of multiplication is habitually employed in chemical formulae to denote combination. I notice that by some accident the number 73 is given as the molecular weight of hydrochloric acid, instead of 36·5.—ALEX. W. WILLIAMSON.

Acids from Palm Oil.—Sir, I wish to know the quantities of hard white palmitic acid and liquid oleic acid which are usually procured from one ton of average palm oil by saponification, followed by distillation and cold and hot pressure. 2ndly. What proportions of the fatty acids are procured from tallow by the lime process, as adopted generally on the continent. I find sundry loose statements in various technical publications, but as they differ so widely I am anxious to learn from some practical person what are the real results obtained in actual working.—DELTA.

Refrigerating Machine.—Sir,—Is there any manageable machine in use for manufacturing purposes, for cooling mother liquors.—P.

Distilling Oil.—Sir,—Can any of your readers inform me of any work that treats of oil distilling. I can find no information in any work on chemistry. I want information on rosin oil distilling and refining, and the improvements made in this branch of business. What is the best process for refining rosin oil, nearly destitute of smell and of a bluish colour?—H. J.

Cheap Grease.—Your correspondent, J. S. W., should try a grease made from the last oil or grease obtained during the distillation of coal tar, or he could try a mixture of rosin and the grease referred to. If your correspondent added a small quantity of the commonest soap to the grease, he would find a great improvement. This would make the cheapest grease for colliery and other purposes.—H.

Charcoal Biscuits.—Sir,—To the receipt given last week add two ounces of levigated cedar wood charcoal, to be mixed intimately with the flour.—CORRESPONDENT.

ANSWERS TO CORRESPONDENTS.

* * * Owing to the growing demands upon our limited advertising space it has been rendered necessary to omit the Table of Contents in future from the front page of the CHEMICAL NEWS.

We have been requested to correct an error which has been very generally made by the English Press, (the CHEMICAL NEWS included). In the list of firms which have gained silver medals at the Paris Exhibition, the well-known firm of *Morsen and Son* has been misprinted *Mawson*.

J. S.—We have been unable to find the paragraph in question; about what date did it appear?

W. H. A.—There is no difficulty in taking ink stains from paper. Most acids will effect the desired object. The principal thing to be attended to, is to remove every trace of the acid from the paper after it has done its work. This is a difficult thing to do properly, and its neglect is the cause of the rotting so often complained of after the removal of ink-spots.

W. J. S.—The term photograph is the generic name applied to all pictures taken by the agency of light. A daguerreotype is, therefore, as much entitled to be called a photograph, as a paper print from a collodion negative.

A. Druggist.—Picrate of potash has been used by Braconnot as a substitute for quinine, in intermittent fevers; the dose is from two to five grains. It is said to answer very well, but makes the patients as yellow as guineas.

J. R.—Sulphate of baryta is soluble in hot strong sulphuric acid, but water precipitates it.

A Manufacturer.—If you advertise in our pages you will be certain to receive many answers.

S. Johnson.—To dye silk with gold, immerse the stuff in a bath of chloride of gold for ten minutes, then wring and dry. Expose to the sun-light, when the colour changes to a beautiful lilac.

Papering Damp Walls.—Sir,—One of the walls in my house is so damp that the paper will not stick; it mildews and peels off within a few months. I am not a chemist, but I should think that some of your correspondents will be able to suggest a remedy.—R. A., Dudley.

Communications have been received from, F. A. Abel, F.R.S.; Dr. Letheby; W. B. King; Morsen and Son; H. B. Condy; Sir B. C. Brodie, Bart. F.R.S.; Dr. F. C. Calvert, F.R.S.; B. Westermann and Co. (New York); G. Hill; H. Woodward; D. Forbes, F.R.S.; G. F. Rodwell; E. Beanes; Dr. Odling, F.R.S.; W. Bright; Albright and Wilson, with enclosure; J. Kayess; C. R. C. Tichborne; Muspratt Bros.; Dr. Oxlard; John Tilley; Professor Williamson, F.R.S.

Books Received: "Researches on Gun Cotton," by F. A. Abel, F.R.S., being the Bakerian Lecture for 1867.

THE CHEMICAL NEWS.

VOL. XVI., No. 398.

ON THE

RECOVERY OF SULPHUR FROM ALKALI WASTE.

By LUDWIG MOND.

ALKALI waste, black ash waste, tank, vat, or blue waste, are the different names of the insoluble residue obtained by the lixiviation of artificial crude soda, or black ash, produced by Leblanc's celebrated process for the manufacture of alkali, which, in spite of innumerable attempts to supersede it, still furnishes almost alone the very large quantities of alkali at present consumed, and has undergone hardly any essential change since its illustrious inventor introduced it about eighty years ago. This superiority to all other known processes is undoubtedly, to a great extent, due to the production of the above named waste, on account of the valuable property it possesses of separating completely and easily from the alkali in the black ash by lixiviation. Nevertheless this waste has been always regarded as the greatest drawback to this important manufacture. Every ton of alkali produces no less than $1\frac{1}{2}$ tons of dry waste, and the enormous quantities thus obtained are generally deposited in the neighbourhood of the works, often forming hills of considerable height. In damp weather especially this waste evolves large quantities of sulphuretted hydrogen, that most noxious and most disagreeable of all gases, sadly annoying the surrounding population; and, moreover, the rain and ground-water coming into contact with it dissolve out considerable quantities of yellow liquor containing hydrosulphide and polysulphide of calcium, which poisons the water of all wells and rivers to which it has access. These evil results are altogether due to the sulphur contained in the waste, which amounts to no less than 80 per cent of all the sulphur used in the manufacture of alkali, and which represents, of course, a very considerable value. All efforts to recover this sulphur by a cheap and simple method, and thus also to do away with the nuisance of the waste, have until lately failed in their object, though a great many distinguished chemists and intelligent manufacturers have for the last thirty to forty years devoted much time and expense to this important task, amongst whom Mr. William Gossage (to whose well known labours we owe so many valuable improvements in the manufacture of alkali) takes again the first place. A considerable number of methods have been described and patented, none of which, however, have overcome the principal practical difficulty of the question,—to treat the large quantities of waste without employing too much labour and too large a plant.

It is only within the last few years that sulphur has for the first time been regularly manufactured from alkali waste, by a process of the author's invention, and so rapid has since then been the progress of this new industry, that at this year's Paris Exhibition no less than seven works exhibit sulphur recovered from waste by three different methods, all of which have been patented in England as follows:—L. Mond, 8th September, 1863; M. Schaffner, 23rd September, 1865; P. W. Hofmann, 9th April, 1866. All these processes are based on the same principle—viz., conversion of the insoluble sulphide of calcium in the waste into soluble compounds by bringing the waste into contact with air in order to oxidise it. Lixiviation of the oxidised mass and precipitation of the sulphur in these liquors by a strong acid, in practice of course muriatic acid.

This principle has already been described by W. H. Leighton, in his patent for improvements in converting sulphate of soda into sub-carbonate of soda, dated October, 1863. He proposes to allow waste to remain in the vats until it heats and gives off smoke, then to lixiviate

and to precipitate the sulphur from the liquor thus obtained by muriatic acid. It is, however, not probable that he ever worked his process out, no account of it being found, except that in the Register of Patents. In 1852 W. S. Losh took out a patent for obtaining hyposulphite of soda by exposing waste in heaps to the atmosphere, lixiviating it, adding carbonate of soda to the liquor, and crystallising. This process has ever since been worked very successfully at the Walker Alkali Works, near Newcastle, where about six tons of hyposulphite of soda per week are produced. Being engaged in researches on the different processes for sulphur recovery by Mr. Gossage and others in the summer of 1860, my attention was drawn to Mr. Losh's patent, and I at once started a series of experiments in order to ascertain whether, and under what conditions, a quantity of hyposulphite of lime could be obtained by oxidation of the waste, which would render practicable the extraction of sulphur on a large scale, and its recovery by means of muriatic acid. I soon found out that the formation of soluble sulphur compounds in the waste increased only up to a certain maximum, when sulphur to the extent of about 5 per cent of the weight of the dry waste could be extracted by lixiviation, and that this quantity decreased by exposing the waste any longer. When these soluble compounds, however, were washed out, the waste oxidised quite as well a second time, a similar quantity of sulphur being obtained again, and this treatment could be advantageously repeated even a third time.

The waste I used for these experiments being lixiviated by a singular method, since abandoned, was, however, so dense that all efforts to oxidise it in heaps, or by forcing air through it, failed, so that I had to expose it in shallow layers on shelves. This process was patented in France in December, 1861, and in England in August, 1862, and sulphur to the extent of 12 per cent of the waste has been obtained by it in considerable quantities in a German alkali works.

Coming to England, in the autumn of 1863, I very soon found, however, that the enormous quantities of waste to be treated, and the high rate of wages, made this process quite impracticable here, and that the waste produced by the excellent process of lixiviating black ash, in general use in this country, was very likely to allow of a much more simple treatment. I tried again to oxidise it by forcing air through it, and succeeded so well that the time necessary to oxidise and lixiviate the waste, which had previously been six to eight weeks, was soon reduced to 60 or 80 hours, and that manual labour was almost altogether avoided by performing these operations in the same vat in which the waste was produced without moving the latter. These facts led to a new process, which was patented the 8th of September, 1863, since when there have been no alterations in the main features of the process described in my specifications of that date. In place of the set of four vats, generally in use for lixiviating black ash, I employ a set of ten or twelve. All of these are connected by pipes in the usual way, so that the soda liquor runs from the bottom of one vat to the top of the next one, and by special pipes and taps which allow the sulphur liquor to run out of the bottom of each vat to the top of any other vat in the set. Besides this, they are provided with extra taps and shoots to convey the sulphur liquor to wells or settlers. The lower parts of all the vats are connected with a fan, capable of producing a pressure of about 7 inches of water by pipes with dampers, which regulate the quantity of air passing through. A silent fan of Schiele's construction, 20 inches diameter, price £10, propels a sufficient quantity of air for the treatment of the waste resulting from 100 tons of salt-cake per week. Four of the vats are always filled with black ash in the course of lixiviation, the other six or eight with waste to be treated according to my invention. As soon as the black ash is completely spent and the weak liquor well drained off, the connection with the fan is opened. The waste soon begins to heat, the

temperature gradually rising above 200° F., and gives off quantities of steam, becoming greenish and afterwards yellow on the top, gets more and more dry, and would take fire if the air was passed through long enough. The period at which oxidation should be stopped, and the passing of air discontinued, so as to give the best results, must be ascertained in each works by experiment, and varies according as much or little hyposulphite in the liquors is desirable. In the beginning of the action, hydrosulphide and bisulphide of calcium are formed, which are afterwards oxidised into hyposulphite. A part of the hyposulphite is again decomposed into sulphur and sulphite, which is very insoluble and cannot be extracted by lixiviation. Carrying the oxidation too far would therefore entail a serious loss. On an average, the time of exposure will be limited to between 12 and 24 hours. The waste is now lixiviated systematically with cold water, the weaker liquors passing from one vat to the next one in course of lixiviation, so as to obtain only strong liquors, which operation can be easily performed in six to eight hours. When this lixiviation is finished, air is again passed through the waste in exactly the same way as before; the waste is again lixiviated, and the same treatment repeated a third time. The vat is then ready to be cast, and is again filled with black ash. When the operations have been conducted well sulphur equal to about 12 per cent of the weight of the salt-cakes used in making black ash is obtained in solution from the waste. The waste contains only traces of sulphide of calcium, and is principally composed of carbonate of lime, sulphite and sulphate of lime, which, far from being noxious, make the waste, on the contrary, a valuable manure. In separating the sulphur from the liquors thus obtained, by adding muriatic acid, I met with much more difficulty than I had anticipated from apparently so simple a reaction.

(To be continued.)

ON THE APPLICATION OF THE BLOWPIPE TO THE QUANTITATIVE DETERMINATION, OR ASSAY OF CERTAIN METALS.

By DAVID FORBES, F.R.S., &c.

(Continued from page 2).

Silver Assay.

I. A. METALLIC ALLOYS CAPABLE OF DIRECT CUPELLATION.

- b. Consisting chiefly of silver: native silver, bar, test, and precipitated silver, retorted silver amalgam, standard silver, silver coin, and other alloys of silver with gold and copper.

These alloys may be at once fused with lead on the cupel itself, and the operation finished as before described. In general, however, it is better to fuse the weighed assay previously with the requisite amount of pure lead and a little borax-glass, say from a quarter to half the weight of assay, in the reducing flame at a low heat on charcoal until the globule commences to rotate. This ensures having a perfectly clean button of silver-lead, which is then cupelled in the ordinary manner.

In most cases the quantity of lead to be added need not exceed that of the weight of the alloy, but when several percentages of copper are present in the assay, as in case of many coins, &c., the lead should be increased to some three, or even five times the weight of the assay in proportion to the amount of copper actually contained in the substance under examination, and which will be treated of more at length under the head of copper-silver alloys.

When no more lead has been added to the assay than its own weight, the cupellation may be concluded in one operation by inclining the stand, and so moving the globule on to a clean part of the cupel; but when more

copper is present, it is preferable to concentrate first and cupel subsequently, in order thereby to reduce the cupellation loss to its minimum.

In the concentration as much copper as possible should be slagged off with the lead, which is effected by inclining the cupel somewhat more than usual, so that its surface may be less covered up with the litharge and exposed as much as possible to oxidation, by which means the litharge, as it forms, is enabled to carry off more of the copper contained in the silver lead.

Should the silver globule after cupellation show indications of still containing copper, as before noticed, when treating of cupellation, a small quantity of lead must be fused along with it, and the cupellation finished as usual.

As at the present time no means are known by which silver can be separated from gold by the use of the blowpipe, in all cases of alloys containing gold, this metal remains to the last along with the silver, and the result in such cases always indicates the combined weight of both these metals contained in the alloy under examination. The employment of the humid assay must be resorted to for effecting their separation:—

- c. Containing chiefly copper: native copper, ingot, wire, or sheet copper, cement copper, copper coins, copper-nickel alloys.

Under the most favourable conditions in cupellation, the amount of lead requisite when converted into litharge to slag of one part of copper along with it as oxide, amounts to between seventeen and eighteen parts its weight. In the blowpipe assay it is usual to add to any cupriferous alloy an amount of pure lead equal to twenty times the amount of copper contained in the alloy, in order to ensure the whole of the copper being separated in the litharge. In the case of nickel the amount of lead required is somewhat less than with copper, but in practice the same amount of lead may be employed.

When the copper is quite clean the requisite amount of lead may be added to it in a single piece on the cupel, fused and cupelled as usual, after previous concentration of the silver lead to a small-sized globule.

It is generally found, however, that traces of iron, slag, gangue, or other foreign matter is present; and, consequently, it is usually advisable to fuse the assay along with the requisite amount of lead, and about one half its own weight of borax-glass in the reducing flame, until the whole of the substance is seen to have perfectly combined or alloyed with the lead, and the globule has come into brisk rotation, whilst at the same time no detached metallic globules are seen in the borax-glass.

The concentration of the silver lead and cupellation are then conducted as usual, taking care when concentrating to incline the cupel-stand so as to expose as much of the metallic surface of the melted globule to the oxidising action of the air as possible, with a view of enabling the litharge whilst forming to carry off as much copper along with it as possible.

Should the silver globule obtained after cupellation spread out, or appear to the eye more flattened than usual with globules of pure silver, it indicates that some copper still remains, and a small piece of assay lead ($\frac{1}{2}$ to 1 grain weight) should be placed alongside it whilst still on the cupel, fused together, and the cupellation finished on a clean part of the same cupel as usual.

Precipitated or cement copper, especially that which is in the crude state, and has not been melted and run into ingots, is often very impure, containing so much iron, lead, arsenic, earthy matter, &c., as not to admit of direct cupellation, and in such case should be treated as pertaining to class B. a. :—

B. METALLIC ALLOYS INCAPABLE OF DIRECT CUPELLATION.

- a. Containing much copper or nickel, with frequently some little sulphur, arsenic, zinc, iron, cobalt, &c., as unrefined or black copper, brass, German silver, &c.

As the presence of these extraneous matters would interfere with the cupellation either by causing a loss of silver-lead projected from the cupel upon the evolution of the volatile substances present, or by forming oxides which could not be absorbed by the cupel, it is necessary to eliminate such substances by a scorification with borax on charcoal previous to concentration or cupellation.

In the case of unrefined and black copper, the portion used in the examination is placed in the scoop with twenty times its weight of assay lead, and its own weight of powdered borax-glass, mixed with the spatula, and transferred to a soda-paper cornette. It is then fused on charcoal in the reducing flame, which should be constant and uninterrupted, until all particles have completely united, and a brisk rotation sets in, which is kept up for a short time, when the silver-lead globule, which should appear bright on the surface after cooling, is concentrated and cupelled precisely as is directed under A. c. By this preliminary scorification the sulphur, arsenic, and zinc are volatilised, and any lead, cobalt, or iron slagged off into the borax-glass.

In the assay of brass and German silver, the quantity employed is fluxed with its own weight of borax-glass, but only requires ten times its weight of assay lead. The operation is commenced as before, but the globule is kept somewhat longer in rotation (always keeping the flame directed only on to the borax-glass), so as to allow the zinc present to be completely volatilised, which is evident when the surface of the silver-lead becomes bright, on which the heat is increased for a few moments to expel the last traces of that metal, and the silver lead thus obtained is concentrated and cupelled as before.

The silver globule obtained from the cupellation of substances rich in copper generally requires the addition of a small quantity of lead and re-cupellation (as before described), in order to ensure its freedom from copper.

ON CROOKESITE,

A NEW MINERAL CONTAINING THALLIUM.

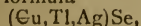
By M. A. E. NORDENSKIÖLD.*

THE long abandoned mine of Skrikerum is well known to chemists and mineralogists as the spot where seleniferous minerals were first discovered. The richness of the Stockholm museum in seleniferous minerals induced me to re-examine these combinations. During this research I have discovered that the new metal thallium exists in small quantities in eukairite and berzelianite; but, at the same time, I found in Mosander's collection some specimens of a mineral containing as much as 19 per cent of thallium, which I have named *Crookesite*, after the discoverer of the metal. This mineral is for thallium what eukairite was for selenium.

Crookesite forms small coherent, opaque masses of metallic lustre, has a lead-grey colour, and sufficiently compact to admit of its ready separation from the grains of eukairite and the powder of berzelianite. I have observed no trace of crystallisation in the mineral. In tenacity and hardness it resembles chalkosine. Its specific gravity = 6.9.

Before the blowpipe crookesite fuses easily, forming a lustrous green-black enamel; the flame is coloured intensely green. It is insoluble in hydrochloric acid, but nitric acid dissolves it readily and completely.

Analysis led to the formula



which requires—

Copper	45.76
Thallium	17.25
Silver	3.71
Selenium	33.28

100.00

The small quantity of silver is derived from a trace of eukairite.

Hitherto only a few specimens of crookesite have been found in the mineralogical collection of the Stockholm museum; but it is to be hoped that more may be found upon searching in the mine of Skrikerum.

ON THE SUPPOSED NATURE OF AIR PRIOR TO THE DISCOVERY OF OXYGEN.

By GEORGE FARRER RODWELL, F.C.S.

(Continued from Vol. XV., p. 313).

XVII. Denys Papin.—We have previously considered the labours of the Royal Society and of the *Academie des Sciences* from the time of the foundation of those societies to the year 1673; during the succeeding decade we find scarcely one paper of importance relating to the air, either in the "*Philosophical Transactions*" or in the "*Memoires de l'Academie*." The science of pneumatics had grown so rapidly during the first twenty years of its existence, that it now somewhat slackened its pace; it is impossible for a science to be uniformly progressive, and the preceding period had been brilliant in discoveries, which had succeeded each other with rapidity. The discovery of the pressure of the air had been immediately followed by the tentative and crucial experiments of Pascal, then came the experiments of Otto Von Guericke, Boyle, Hook, and the *Academia del Cimento*, while pneumatic chemistry received its first start in life from John Mayow. Such a cluster of discoveries could not be looked for again, and we are consequently prepared to find scientific literature somewhat sparsely supplied with pneumatic researches during the succeeding period.

In the *Philosophical Transactions* for 1675 there are several papers by Christian Huygens* and Denys Papin†. In one of them, entitled "*Pneumatical Experiments made with the air-pump*," we have an account of some experiments relating to the mutual reaction of different bodies in vacuo, and the observance of the tension of the evolved gas; thus, nitric acid was poured upon copper filings, and sulphuric acid upon carbonate of potassium, and it was noticed that while the gas produced by the former reaction remained at the same tension for any length of time, that produced by the latter reaction vanished completely in the course of twenty-four hours. It is to be borne in mind that a water gauge was employed for measuring the tension, moreover water was used to render the piston of the air-pump tight, and not unfrequently found its way into the receiver; the disappearance of the one gas was therefore due to its being absorbed by water, while the other remained unaffected. Again, in the *Philosophical Transactions* for 1676 we find two pneumatical papers jointly by Huygens and Papin; in the second of these there is an account of an attempt to determine the volume of gas produced by the explosion of gunpowder. In order to ascertain this a known weight of gunpowder was placed in a receiver of known capacity, together with a gauge for showing the tension of the evolved gases; when the receiver was well exhausted, the gunpowder was fired by means of a lens. It was then calculated that one-fifth part of gunpowder consists of gas, which is "compressed" in the powder to one-three-hundredth of its volume when free. This gas, the authors remark, must come from the nitre, as sulphur yields no permanent gas when it is melted in vacuo.

In the *Memoires de l'Academie*, the only paper relating to our subject, which appeared during the decade, is by Mariotte; it was communicated in 1679, and is entitled "*Sur la Nature de l'Air*." It relates chiefly to the absorption of air by water, and the experiments are for the most part modified forms of previous experiments. At the conclusion of the paper, Mariotte states his con-

* *Öfversigt af K. Vetenskapsakademiens förhandlingar*. No. 10.

*Born 1629, died 1695.

†Born 1647, died 1714.

viſion that the air is not colourleſs, but pale blue, as may be obſerved when it is viewed in maſs. It is for this reaſon that the ſky is blue, and the tops of mountains bliſh. In ſupport of the theory, he adduces the following experiment:—"Que l'on reſcoive ſur une moitié d'une feuille de papier blanc la lumière d'une chandelle, et ſur l'autre celle de la Lune, ſéparées par quelque corps qui les empeche de ſe mêler, la partie du papier éclairée par la chandelle paroitra rougeatre, parce que cette lumière a effectivement beaucoup de cette couleur, et la partie éclairée par la Lune ſera bleue, parce que cette lumière a traversé toute l'atmoſphere, et y a pris cette teinte."*

Huygens and Papin have been mentioned above as the joint authors of ſeveral papers. Papin, for ſome length of time, ſtudied physics under the direction of Huygens, and aſſiſted him in many of his reſearches, but, after awhile, their purſuits became ſomewhat divergent, for whiſt the latter devoted his attention chiefly to pure mathematics, and to optics, the former ſhowed a greater aptitude for mechanics and pneumatics.

Papin firſt came prominently before the ſcientific world in 1674, when he publiſhed a ſmall work entitled, "Nouvelle experiences du vide avec la deſcription des machines qui ſervent a les faire."†

Some of the experiments were made under the direction of Huygens, and the air-pump employed (and which up to that time had alſo been employed by the *Academie des Sciences*), was deviſed by Huygens, and was a modified form of Boyle's ſecond air-pump.‡ The cylinder was 14 inches long by 3 inches diameter, and contained a valve at the bottom opening outwards; a lateral tube communicated with the receiver, and the piſton was ſolid. This air-pump differed in ſeveral reſpects from Boyle's pump; thus the great inconvenience of placing the pump in water to render all the joints air-tight was diſpenſed with, and the valve was transferred from the piſton to the pump barrel, and was ſelf-acting, inſtead of being worked by hand. This pump is alluded to by Huygens in a "Lettre touchant les phénomènes de l'eau purgée d'air," publiſhed in the *Journal des Savans*, for 1672; it muſt therefore have been conſtructed ſoon after the publiſcation of Boyle's ſecond ſeries of "phyſico-mechanical experiments," in 1669.

The greater number of Papin's "nouvelles experiences" relate to the preſervation of edibles (chiefly fruits) in vacuo, and are very void of intereſt, both on account of their want of novelty, and alſo becauſe of the tedious and prolix manner in which they are deſcribed. We give below one example, which may ſerve as a ſpecimen of much of Papin's writing:—"Le 27 Juillet, 1673.—J'enfermay 4 framboiſes et 3 groſſeilles dans la vuide. Les groſſeilles paroiffent auſſe eſtre tournées, et les framboiſes ſont moins vermeilles qu'elles n'eſtoient, mais il y a plus de 5 mois que je n'y appercois aucun changement. Je les garderay auſſi le plus long-temps que je pourray."

In the laſt chapter Papin gives an account of a new air-pump which he had deviſed, and which differed ſomewhat from thoſe which preceded it. In Boyle's ſecond air pump, and in the modified form of it deviſed by Huygens, the open end of the pump barrel was placed uppermoſt, as in the preſent day. This arrangement was reverſed by Papin, who returned to Boyle's original plan of having the open end downwards; but inſtead of a rack and pinion, Papin connected the piſton rod with an iron ſtirrup, ſo that the pump ſtood on the ground and was worked by means of the foot. The air-pump plate was immediately above, and at right angles to the barrel, and the whole pump was about four feet high. The pump was very complex in its conſtruction, and the only notable

improvement was in the air-pump plate, which was ground, as alſo was the receiver, ſo that the tedious method of cementing the receiver to the pump plate, previously in vogue, was avoided. We alſo here firſt find mention of the uſe of a leather collar with a braſs rod paſſing through it for moving bodies in the receiver during the continuance of the vacuum. To guard further againſt the leakage of air, a ſmall receptacle, filled with water or treacle, was placed above the leather.

In the "Conſervatoire des Arts et Metiers" there is a very old air-pump deſcribed ſimply as "Très ancienne machine pneumatique, a un corps de pompe," of which I have been quite unable to find any account, either in recent works, or in memoirs of the period. It conſiſts of a tripod ſtand upon which reſts a horizontal pump barrel about eight inches long by four inches diameter; the pump plate is immediately above it, and the piſton is worked by a handle, which, by means of ſome unexposed appliance immediately beneath the barrel, gives motion to two ſliding rods with a croſs piece attached, to which latter the piſton rod is connected. In the *Memoires de l'Academie* for 1683, in a paper entitled "Diverſes Observations de Phyſique Générale," it is ſtated that an air-pump conſtructed by a M. Delancé had been employed in ſome determinations of the relative weights of air and water. This may poſſibly be the pump in queſtion, but no deſcription is given of it.

Shortly after the publiſcation of the "Nouvelle Experiences du Vide" (viz., in 1675, or the early part of 1676), Papin went to England, and took with him a double-barrelled air-pump, which he had recently invented. Boyle for ſome time had been unable to carry out any experiments on account of ill-health, and at the time of Papin's arrival he was ſeeking for an amanuenſis. Papin immediately offered his ſervices, at the ſame time ſhowing him his recently publiſhed work, and the double-barrelled air-pump, which there ſeems to be every reaſon to believe was conſtructed in 1675. Papin became Boyle's amanuenſis in 1676, and remained for ſome length of time in his ſervice, during which he conducted a number of experiments at Boyle's ſuggeſtion, chiefly with a view of teſting the accuracy of previously made experiments: theſe were publiſhed, together with a deſcription of the new air-pump, in 1680, in a work written by Papin,* but read over and reviſed by Boyle, whoſe name alone appears on the title-page. It was written in French, and tranſlated into Latin before printing; a tranſlation into Engliſh was ſubſequentlly publiſhed.

It commences with a deſcription of Papin's double-barrelled air-pump, which conſiſted of two vertical cylinders of braſs, in each of which worked a piſton fitted with a valve opening upwards; at the bottom of each cylinder there was alſo a valve opening upwards; indeed the pump was precisely ſimilar to that uſed in the preſent day as regards the fitting with ſelf-acting valves, and only differed in the mode of working the piſtons. At the top of each piſton rod a metal ſtirrup was fixed, and theſe were connected by a cord paſſing over a pulley. The pump was worked by a man who, putting one foot into each of the ſtirrups, threw the weight of his body firſt upon one piſton and then upon the other; thus the action ſomewhat reſembled that which is practiſed on a tread-mill. The advantages of the double pump barrel over the ſingle barrel are conſiderable: in all the previous air-pumps the piſton had to be drawn from one end of the barrel to the other againſt the whole preſſure of the atmoſphere, but by the introduction of two barrels, and the connection of the piſton rods, ſo that the deſcent of one piſton cauſed the aſcent of the other, it will be perceived that the piſtons balance each other, for the

* "Histoire de l'Academie Royale des Sciences depuis ſon établiffe-ment en 1666 juſqu' a 1686."—Paris, 1733.

† This work was publiſhed in Paris, by Jean Cuſſon. It is dedicated to Huygens, and contains 28 pages and two plates. Apparently only a ſmall number were printed; it is now very rare.

‡ For an account of which ſee the 13th of theſe papers, *CHEMICAL NEWS*, Vol. 12, p. 62.

* This work is entitled "A Continuation of New Experiments phyſico-mechanical, touching the ſpring and weight of the air, and their effects." The ſecond part. By the Hon. Robert Boyle. London, 1680. The firſt part of the continuation was publiſhed in 1669; an account of it will be found in the thirteenth of theſe papers, *CHEMICAL NEWS*, Vol. 12, p. 62.

downward pressure of the atmosphere upon one, balances the pressure tending to press down the other. Thus a double-barrelled air-pump not only exhausts in half the time required by a single-barrelled pump, but requires less force to work it.

The degree of rarefaction which obtained in the receiver was measured by a mercury gauge enclosed within the receiver. It consisted of a graduated tube sealed at one end and filled with mercury, with the exception of a small space occupied by a bubble of air, by the expansion of which the degree of rarefaction was ascertained.

The first experiment is dated July 11th, 1676, and relates to "several waies used to help the production of air." The work, for the most part, treats of the preservation of edibles in vacuo and the amount of air produced by various substances when kept for a length of time in closed vessels. There is nothing of interest or utility among the experiments, which much resemble those described in Papin's former treatise.

Among other things, we find an account of Papin's wind-gun and of some experiments made upon animals in compressed air. A mouse was placed in the receiver of the gun, and the air rapidly compressed to one-twentieth of its former volume, the gun was then discharged, the receiver opened, and the mouse was found to be dead, at which Papin expresses great surprise, as he expected to find it "only a little convulsive." A second mouse was then placed in the receiver, and the air compressed to one-fourth its original volume. On discharging the gun and opening the receiver, the mouse was found to be alive and well. Finally, a mouse was left in air compressed to one-seventh of its volume for 24 minutes, and the gun then discharged. When the mouse was taken out it was observed "to fetch many deep groans," and soon after it died, from all of which experiments he deduces the corollary, "That a great compression of air is noxious, yea mortiferous to animals."

In 1684, Papin was appointed curator to the Royal Society with a salary of £30 a year, for which he was to show at least one experiment at each meeting of the society. It will be borne in mind that this office had previously been held by Hooke, now one of the secretaries to the Society.*

(To be continued.)

ON THE UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

As you are aware, the residual products of gas-making are six in number—namely, *coke*, *ammoniacal liquor*, *coal tar*, and the three waste products from the purifiers, as the *spent oxide of iron*, the *refuse lime*, and the *acid or other matters used for absorbing ammonia*, each of which has its special value on account of its technical uses.

I.—COKE.

This need not occupy much of our attention, as its practical value and uses are pretty well known to you. I may say, however, that it was the opinion of the late Dr. Fyfe, and is still the opinion of many chemists who have examined the power of coal under steam-boilers, that the heat actually made available in practice is very nearly the same as ought to be produced according to theory by the quantity of coke which the coal yields. He found that a pound of Scotch coal from Trenant would boil away 5.61 lbs. of water, and that the coke of it, which amounted to 0.525 of a pound, produced 3.9 lbs. of steam; so that the practical loss was $5.61 - 3.9 = 1.71$ lbs.; but the theoretical value of the coke was about 5.5 lbs. of steam. Here is a table of the relative heating power of different fuels,

expressed in the number of pounds of water which 1 lb. of the substance will boil away when the water has been heated to its boiling-point:—

Dry wood (average of many specimens)	4.51 lbs.
Derbyshire coal (ditto)	7.58 "
Scotch coal (ditto)	7.70 "
Lancashire coal (ditto)	7.94 "
Newcastle coal (ditto)	8.37 "
Welsh coal (ditto)	9.05 "
Good coke (ditto)	10.00 "

If all these numbers are multiplied by 5.5, they give the quantity of water which a pound of the fuel will in each case raise from 32° to 212°, and the results show that the thermotic power of coke is very high.

II.—AMMONIACAL LIQUOR.

This is the aqueous portion of the condensed products of the gas. It floats upon the tar, and is a watery solution of carbonate, sulphide, and sulphocyanide of ammonium, with certain carbohydrogens of no value.

If all the nitrogen contained in coal were converted into ammonia, so as to make a liquor of 8-oz. strength (4° Twaddle), it would yield from 142 to 226 gallons per ton of coal. This will be evident from the table which is before you, and which represents the average amounts of nitrogen in certain well-known coals in a dry condition:—

	Nitrogen per cent in Coal.	Ammonia per cent in Coal.	Gallons of Liquor of 4° Twaddle p. ton of Coal.
Welsh coal (average)	0.91	1.10	142
Lancashire coal (ditto)	1.25	1.52	196
Newcastle coal (ditto)	1.32	1.60	206
Scotch coal (ditto)	1.44	1.75	226

But by far the largest portion of nitrogen is not converted into ammonia, for by combining with sulphur and carbon it forms the sulphocyanides which are so abundant in ammoniacal liquor and in spent lime, and much of it also unites with carbon and hydrogen to produce the alkaloids which exist in the tar. In practice, therefore, you get but a comparatively small proportion of the nitrogen as ammonia in the ammoniacal liquor. The quantity of liquor rarely exceeds 45 gallons of 8-oz strength per ton of coals; and to obtain this quantity you must condense well, and also wash the gas with water. I have already explained to you how this is done at the Birmingham and Staffordshire Gas Works by Mr. Hugh Young, who obtains 44 gallons of liquor per ton of Staveley coal in his yearly working. In ordinary practice the yield is about 25 gallons per ton, and in London it is not above 13 gallons—calculated in every case as 8-oz. liquor. You will see from this how largely the production of ammoniacal liquor may be increased; and I will call to your recollection the valuable advice of your president, Mr. Hawksley, with respect to the copious washing of raw gas with ammoniacal liquor, for this practice has a twofold advantage—it not only purifies the gas by removing tarry matter and sulphur compounds, but it also strengthens the liquor and renders it a more valuable product. By using the liquor as a shower or in a scrubber, in the proportion of 1 volume of liquor to 16 of gas, the liquor may easily be raised to 10° or 11° of Twaddle, which are equivalent to from 20 to 22 ounces of acid; and considering that the price of liquor rises about 4d. or 6d. per butt for every degree of Twaddle, it is manifestly of the greatest importance that the liquor should be sent away from the works as strong as possible. It ought, in fact, never to be under 6° of Twaddle, or of less than 12-oz. strength; and, with proper condensation and judicious washing, there should be from 29 to 30 gallons of such liquor produced from every ton of coals. The average price of ammoniacal liquor of 8-oz. strength, in eleven towns of England, is at the present time 2s. 7d. per butt of 108 gallons. It ranges from 1s. 9d. to 4s. 6d. per butt, and in London it fetches 2s., with an increase of 4d. per butt on every additional ounce of acid strength. Below 3° of Twaddle or 50% of acid it does not pay for working, whereas at 10° or 11° of Twaddle it is a valuable

* See the tenth of these papers, CHEM. NEWS, vol. ii., p. 38.

† A lecture delivered before the British Association of Gas Managers. Corrected and communicated to this paper by the Author.

product. The strength of the liquor may be estimated either by the hydrometer or by the quantity of strong sulphuric acid (sp. gr. 1.845) required to neutralise it; and it will be found that every degree of Twaddle is equal to about 2 ounces of acid per gallon of liquor.

The method of converting the liquid into a salt of ammonia varies in different places according to the facilities for working. In some places the liquor is at once saturated either with sulphuric or muriatic acid, in a close tank, and the evolved gases (sulphuretted hydrogen and carbonic acid) are carried to a furnace or to a furnace shaft. The saturated liquor is then evaporated and crystallised in open troughs. This, however, produces a dark-coloured salt which is not very saleable. The liquor, therefore, is either distilled alone from a steam-boiler, or it is mixed with lime in the boiler, so as to fix the sulphuretted hydrogen and carbonic acid, and is then distilled. In many works the liquor is heated in an apparatus called a Coffey's still, which is a tall vessel containing a number of transverse divisions (from 20 to 30) which alternately pass to nearly the opposite sides of the vessel. The liquor is run in at the top, and as it flows from side to side over the alternate divisions, in its way downwards it meets a rush of steam, which is admitted at the bottom of the vessel, at a pressure of from 20 to 30 lbs. upon the inch, and thus the carbonate and sulphide of ammonium are volatilized. In all these cases the ammonia is distilled into a close vessel containing sulphuric acid, diluted with enough water to prevent the salt from crystallising (equal parts of brown chamber acid of commerce and water are good proportions); and the evolved gas (carbonic acid and sulphuretted hydrogen) is conveyed to the furnace fire, or is used for the production of oil of vitriol. When the ammoniacal liquid is evaporated by blowing steam into it, it is necessary to have a worm, or other cooling apparatus, to condense the water from the gases before they are carried to the furnace, or they will perhaps extinguish the fire. While the distillation is going on the acid in the saturating vessel is frequently examined, and when it is thoroughly neutralized, it is run out into a proper receiver, and is then transferred to shallow pans or troughs, where it is evaporated to the crystallizing point.

The residual liquor from the stills is not completely exhausted of ammonia, but contains from 3 to 5 ounces of sulphocyanide of ammonium per gallon. It is, therefore, treated with lime, and again distilled, whereby more ammonia is obtained.

If there were a large demand for the sulphocyanide, it might perhaps be worth while to recover it from the spent liquor by evaporation, especially where it could be done by waste heat. Here is some of the residual liquor, and you will notice that when I add to it a very acid solution of a persalt of iron it produces a deep blood-red colour of the ferric-sulphocyanide. Here also is some of the salt obtained from the liquor by evaporation, and it is well suited for the preparation of this white powder, the mercuric sulphocyanide, which is the sole constituent of the little toys called Pharaoh's serpents. Sulphocyanide of ammonium is also used to some extent by photographers. I may here mention that the watery solution which runs from the hydraulic mains with the tar, when the temperature is not below 150° Fahr., contains this salt, without any carbonate or sulphide of ammonium; there is no reason, therefore, why this solution may not be collected, apart from the true ammoniacal liquor which is found in the condensers, for even if it be not of much value on its own account, it might be kept from diluting the liquor in the first stages of condensation, and be afterwards used instead of water for finally washing the raw gas.

In country gas-works, where there is no little or no sale for ammoniacal liquor, it would not be difficult to convert it into sulphate of ammonia, by transferring it to an old boiler, then blowing steam into it, and carrying the vapours into a properly constructed vessel, charged with the brown

sulphuric acid of commerce, diluted with the mother liquor of a previous crystallisation. In this way every ton of coals should yield about 30 lbs. of sulphate of ammonia.

This sulphate is worth from £12 to £14 per ton, and it is not merely used for agricultural purposes, but it is the salt from which all other preparations of ammonia are obtained. Distilled with quick lime it yields pure ammonia, which by condensation in water forms the liquor ammoniac of commerce; distilled with chalk it makes carbonate of ammonia; and it has other applications. There are good reasons, therefore, why great pains should be taken to recover all the ammonia of gas-making. We shall presently see how this may be further accomplished by means of absorbent agents placed at the end of the purifiers.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

ON THE ABSORPTION OF GASES BY METALS.

By DR. ODLING, F.R.S., &c.

IN a Friday evening lecture which which I had the honour of delivering here before Easter, I drew your attention to a very singular property possessed by the metal platinum, some very beautiful specimens of which are exhibited in the library, through the kindness of Messrs. Johnson and Matthey, to whom I am also indebted for the greater portion of the articles upon the table. Now platinum, especially that which has been solidified after fusion, appears, at any rate, to be a perfectly homogeneous metal. It does not show the slightest evidence of porosity, and is absolutely impermeable to the passage of gas through it. For instance, if we take a wide platinum tube, drawn out from a single piece of fused platinum, and seal one end by soldering on to it a piece of platinum foil, and similarly close the other end with another piece of foil having a small central orifice, through which a narrow attachment tube projects, we shall have a hollow cylinder of platinum, from which, by connection with the barrel of an ordinary air-pump, or with an air-pump of Sprengel's construction, the air can be exhausted as readily and completely as from a glass tube. That is to say, as perfect a vacuum can be produced and sustained within a tube of platinum as within a tube of glass. Not a particle of air passes bodily from the external atmosphere through the substance of the metal into the internal vacuous space by means of atmospheric pressure, and, what is more to the purpose, not a particle of air passes molecularly through the metal by means of the far more refined and accusing process of diffusion; and this is true, not only of atmospheric air, but of every gas with which the experiment has been made, and is doubtless true of all gases whatsoever. But if, instead of making such an experiment with the platinum tube at ordinary temperature, we make it with the tube at a red heat, under this condition the metal still remains perfectly impervious to the passage of atmospheric air, and of all other gases—except one. One gas alone, under those circumstances, is found to penetrate the platinum, even with very considerable facility, and that gas is hydrogen. The fact that hydrogen has this distinctive property of penetrating ignited platinum, first observed by M. Deville, of Paris, evidently shows that there is something peculiar, something altogether special, in the relation subsisting between the gas and the metal, to which the effect is due. The mode in which the experiment has been recently made is of this kind:—The platinum tube is first attached to an air-pump of Dr. Sprengel's construction, which acts on the principle of the trompe. We have mercury constantly dropping from a constricted funnel down a long narrow glass

tube; and as each drop of falling mercury is sufficient to fill the tube, each such drop acts as a small piston which pushes down a column of air before it, and by pushing down successive portions of air eventually effects a complete exhaustion of any vessel communicating with the fall tube. Indeed, by an instrument of this kind, as perfect a vacuum can be obtained as in the Torricellian vacuum itself, and by its employment a vacuum is easily obtained in the interior of our platinum tube. Before being exhausted, the platinum tube is placed within a tube of porcelain; while in the space between the two tubes a current of hydrogen is continually passed. The internal platinum tube being rendered vacuous, the external porcelain tube is heated in any form of furnace,—in a gas furnace, for instance, as shown here, or in a charcoal furnace; and so soon as the external porcelain tube acquires a bright red heat,—so soon in fact, as the interior platinum tube becomes red hot,—and not till then, do we find that as each drop of mercury falls through the tube of the pump, it carries before it a certain quantity of air or gas which it delivers into this small inverted test-tube of mercury placed for its reception. So soon, therefore, as the platinum tube becomes red hot, a portion of the hydrogen gas confined in the intermediate annular space between the porcelain and the platinum tubes, enters the platinum tube, is exhausted from its interior by means of the Sprengel pump, and is delivered into the test-tube for examination.

There is another metal, namely palladium, one of the platinum group of metals, and closely related to platinum, through which the transmission of hydrogen is yet more easily exhibited, since a temperature very far short of redness is sufficient to render this metal pervious to the gas.

Here is an ordinary apparatus for generating hydrogen. The gas passes through sulphuric acid to dry it, and then through the glass tube in which the palladium tube is contained. You see it from time to time take fire, though it does not burn continuously in consequence of its being delivered through the sulphuric acid in the form of bubbles. The small tube of palladium, contained within the glass tube, is made exactly like our platinum tube, except that it is much shorter. At the present time it is vacuous, having been exhausted by means of the Sprengel pump before the lecture. If you will direct your attention to the small inverted test tube of mercury, you will see that at the present time there is no gas being delivered into it, but we will now heat the palladium tube gently through the glass tube, and long before it gets to a red heat you will find that some of the hydrogen gas which is passing outside the vacuous palladium tube will penetrate through the thickness of the metal into the interior of the tube, be sucked from its interior by means of the Sprengel pump, and delivered into the test tube. I have no doubt that after a few moments, you will see that a quantity of gas will be delivered into the test tube in this way, which gas we shall see to be hydrogen sucked from the interior of the tube of palladium, through the substance of which it has been transmitted. At the present moment, if you listen, you will hear each drop of mercury falling just as it falls in a barometer; but in a few minutes—and I must beg your patience for this experiment, because it will take some little time—we shall lose this clicking sound, through the entrance of gas into the full tube; of which gas, after a little while, we shall get an appreciable volume delivered. A few bubbles of gas have already come over. Those who are near can see that a quantity of gas is being gradually collected in the inverted test tube, which will soon amount to several cubic centimetres. On now putting a light to it, you see that it takes fire and burns in the characteristic manner of hydrogen. Within a few minutes, then, hydrogen, to the amount of several cubic centimetres, has passed from the exterior of the moderately heated palladium tube, through the substance of the tube, into its previously vacuous interior, whence it has been sucked out and delivered by the Sprengel pump.

A curious point of interest is that, in the case of heated palladium, as in the case of ignited platinum, hydrogen is the only gas which passes through the metal. If we take a mixture of hydrogen gas with some other gas, the hydrogen only is sucked through the platinum or palladium, the other gases remaining untransmitted. From the complex mixture of gases, for instance, which constitute ordinary coal gas, hydrogen may be separated in a perfectly pure state by its passage through heated platinum or palladium, which are impervious to all the other coal-gas constituents, as I had the honour of showing you in my former lecture.

Now what is the nature of this transmission of hydrogen through solid metal? On the last occasion, I had an opportunity of demonstrating to you that the phenomenon had no relation to those physical actions which are denominated transpiration and diffusion, but that it was an action of an entirely peculiar character, and was probably preceded by an absorption of the hydrogen in the substance of the metal; and this absorption of hydrogen by platinum, and of other gases by other metals, forms the subject of my present lecture. I wish to show you that in these cases the passage or transmission of the hydrogen gas, through the platinum, or the palladium is preceded by an absorption of the hydrogen gas in the substance of the platinum or the palladium.

The experiment is made in this way: in the first instance some platinum wire is introduced into a porcelain tube of this description, which is closed at one end, and at the other end connected with a Sprengel-pump. The tube is then heated, and its interior rendered vacuous. After the establishment of a vacuum, hydrogen gas is passed over the red hot platinum wire contained in the tube, and the platinum gradually and slowly allowed to cool with the hydrogen gas still passing over it, so that if the platinum has any power of absorbing hydrogen gas it shall have every chance of doing so, and shall, so to speak, select its own absorbing temperature, from the temperature of a red heat down to that of the atmosphere. The platinum was then removed and exposed freely to the air, so that any accidental hydrogen adhering to the surface might be removed. It was then introduced into another tube of this kind, which in this particular case is made of glass in order that it may be seen through, but which, in the actual experiment, was made of porcelain. This tube, containing the charged platinum wire, was attached to the Sprengel-pump, and again perfectly exhausted,—the air removed from it by the exhauster being found absolutely free from hydrogen. Then heat was applied, and, at the moment when the tube became red hot a delivery of hydrogen gas began to take place, and continued for some time, showing that the platinum had absorbed a certain quantity of hydrogen gas, which it delivered up at a red heat under the influence of the vacuum. In the first experiment, then, from fused platinum exposed in this manner to the action of hydrogen at a red heat and gradually decreasing temperature, there was afterwards extracted as much as 21 per cent of hydrogen.

Now what was the nature of this behaviour of platinum towards hydrogen? Did it depend upon surface action? If so it would be increased by an increase of the surface of the platinum. The wire was accordingly drawn out to four times its length, which would give rather less than four times the former surface; but in this case only 17 per cent of hydrogen was extracted after treating the wire as in the previous experiment. Quadrupling the surface, therefore, did not increase the quantity of gas absorbed, and it was found on a repetition of these experiments that the quantity of gas absorbed gradually got less and less. In a third experiment with the same wire, the quantity absorbed amounted to only 13 per cent.

Now comes the question, if this power of the metal to absorb hydrogen is not a question of surface, is it a question of texture? Accordingly, spongy platinum was employed, and in that case it was found that the metal absorbed 148 per cent of gas, that is, about 1½ times its

volume of hydrogen gas, measured at the temperature of the atmosphere. As fused platinum we had the metal in its densest, or rather in its most compact form. As platinum sponge we had it in its most porous form; while as ordinary wrought platinum we have it in a sort of intermediate form—not so porous as the one, and not so compact as the other. What, then, was the result obtained with the wrought platinum? Well, it was found that one volume of wrought platinum absorbed 4.8 times its volume of hydrogen, or 480 per cent. This is the mean of three experiments made with the same portion of platinum. One of them gave 5.5; another gave about 4.9; and the other gave 3.8 volumes of gas. The next experiment was made with a different portion of platinum; and in this case, although the metal contained $3\frac{1}{2}$ times its volume of hydrogen gas (379 per cent.), measured cold, it was found that none of this gas could be evolved into a vacuum except at a red heat. At first the platinum was submitted to a temperature of 240° , but not a particle of gas was given off. The metal was then heated by a small Bunsen burner to a temperature just short of redness for an hour, and still no gas was given off; not, indeed, until the temperature arrived at the point of redness, could any gas whatever be extracted.

We are all of us familiar with the effects of atmospheric pressure, and know that a variety of experiments have been devised by which the results of this pressure may be manifested. One of these is the common experiment of bursting a bladder stretched over a short glass cylinder exhausted by the air pump. [This experiment was performed, a sharp report accompanying the breaking of the membrane.] Now, let us compare the force exerted by atmospheric pressure in this way, with the force exerted by platinum in condensing hydrogen gas. Let us consider the experiments of which the mean result was 4.8. As I have said, one of these experiments gave 5.5; and for the sake of taking round numbers we will say that 5 volumes of gas were absorbed by one volume of platinum. Taking a cubic centimetre of platinum, then, it absorbs five times its bulk of gas. To condense these 5 centimetres of gas into the space of one cubic centimetre, would require the pressure of five atmospheres; or five times the force just exerted by the air in bursting that bladder. But at the temperature at which the experiment was made, these five centimetres were really 15; and accordingly, we have to consider the compression of 15 cubic centimetres of hydrogen into one cubic centimetre, for which purpose we should require 15 times the atmospheric pressure which was just employed. But in reality, this does not represent anything like what has been done. We have not merely compressed these 15 volumes of gas into 1 cubic centimetre of space, but we have compressed them into so much of 1 cubic centimetre of space as appears to be fully occupied by platinum, but is not really so occupied. If we assume, for instance, that in this cubic centimetre, which appears to be all platinum, there is, say, one thousandth part of it which is not platinum, to compress our 15 cubic centimetres of hydrogen into this space would require a pressure of 15,000 atmospheres. So that when this piece of platinum absorbs 15 times its bulk of hydrogen gas at a red heat, it exerts some 15,000 times the compressing force that was exerted by the atmosphere in bursting that bladder.

My time is passing away so rapidly that I fear I shall have to omit a good many points of interest; but I may direct your attention to the fact that, although the evolution of hydrogen by platinum takes place only at a red heat, and indeed some charged platinum that had been preserved for two months was found still to retain the whole of its hydrogen—yet the absorption of the gas by the metal takes place at a much lower temperature. Thus at 230° , platinum absorbed $1\frac{1}{2}$ times its volume, or 145 per cent, and even at a temperature below 100° , the boiling point of water, it absorbed 76 per cent of gas.

When, however, we come to speak of palladium, the facts are far more striking even than with platinum,—palladium

appearing to be a metal altogether special in its relations to hydrogen, which it absorbs abundantly even at a comparatively low temperature. A piece of wrought palladium foil heated to 245° , was found to absorb 526 times its volume of hydrogen, the gas being measured at the ordinary temperature; but it was found that even the temperature of 245° exceeded the most suitable point, and that at the temperature of 100° the metal absorbed 643 times its volume of the gas. Now, if it is a difficult thing to conceive how 15 cubic centimetres of hydrogen should be compressed into the interspace existing in a cubic centimetre of platinum, still more difficult is it to conceive how 6 metres of centimetres of hydrogen should in the same way be compressed, not into one cubic centimetre of space, but into so much of what seems to be a cubic centimetre of palladium as is not really occupied by the palladium. At a temperature falling short of 20° , that is without the limits of ordinary atmospheric temperature, the palladium still absorbed 376 volumes of gas.

In the case of spongy palladium, of which I have here a specimen, there was not such a difference between it and the wrought palladium, as there was between the spongy platinum and the wrought platinum. It was found that the spongy palladium absorbed 680 times its volume of gas, while the wrought palladium absorbed 643 times.

Here is some wrought palladium foil which has been charged in the manner I have described, and now contains some six or seven hundred times its volume of hydrogen locked up or occluded in it. This hydrogen does not come off appreciably, or only in very small proportion, until the metal is heated, but on the application of heat, we shall be able to collect the gas with facility. The piece of foil has been charged with hydrogen gas at a temperature of 200° , then exposed freely to the air, and afterwards introduced into the tube. The tube is then exhausted, and now we are beginning to heat it. On the application of heat, the hydrogen gas will be given off and delivered in the test tube as in the former experiment, the only difference being that in the former experiment we sucked the hydrogen through the tube, and in this case we are extracting the hydrogen which has been absorbed by the metal. It will take some little time for us to collect any considerable quantity, but you see already that the hydrogen gas which was absorbed by the palladium, is now being given off by it. Mr. Roberts, to whose zeal Mr. Graham and myself are both much indebted, has now got the hydrogen in the test tube, and on my applying a light, you perceive the combustion of the hydrogen gas, which we have just extracted from the charged palladium.

The hydrogen gas condensed in this way in the substance of the palladium is capable of exerting certain chemical actions which hydrogen gas in its ordinary state is not. We find that this condensed hydrogen acts as nascent hydrogen, exhibiting all those reducing actions which are characteristic of nascent hydrogen. To give you an illustration of some of these chemical actions of the condensed hydrogen, we have here a solution of permanganate of potassium, into which we will introduce a portion of the palladium charged with hydrogen. The action will not be immediate, but after a little while you will see that the permanganate will become decolorised by the action of the hydrogen which has been absorbed into the palladium. Here we have some solution of the ferricyanide of iron, and on putting into it a portion of the charged palladium, we shall have a gradual development of Prussian blue. The difficulty of the experiment is that the palladium, being heavy, sinks, and does not come much into contact with the liquid; but even now you see that a certain amount of blue tinge has been imparted. You also see that in the other vessel which contains the permanganate a certain amount of bleaching action has taken place. Hydrogen, in this form, will also bleach the iodide of starch. If we introduce into that compound some of this hydrogenetted palladium, hydriodic acid will be formed, and the blue colour of the iodide of starch disappear, though the action will require some little time. In the case of the ferri-

cyanide of iron solution a very decided blueing has now taken place, which will increase to a yet more obvious extent. The permanganate is already almost bleached by the reducing action of the hydrogen absorbed into the palladium, while the colour of the iodide of starch is gradually disappearing. By these results, you see that hydrogen is capable, when thus absorbed, of producing those characteristic chemical effects which, under ordinary circumstances, are only observed of so-called "nascent hydrogen."

There are a great number of other interesting points connected with the absorption of gases by these two metals, palladium and platinum; but my time is getting on so rapidly that I must proceed if you please to consider the absorptions manifested by some other metals. In the case of copper it is found that this metal, in the form of wire, will absorb 30 per cent of hydrogen, whereas in the spongy form it will absorb 60 per cent. Gold is unlike platinum in this particular—that it will absorb a great number of different gases, whereas platinum absorbs hydrogen only. Gold, in the form of assay cornettes, was found to absorb 48 per cent of hydrogen, 29 per cent of carbonic oxide, 16 per cent of carbonic acid, and 20 per cent of air, but of this air, absorbed by the gold, nearly the whole was nitrogen. Whereas ordinary atmospheric air contains 21 per cent of oxygen, the air absorbed by gold contained only 5·3 per cent of oxygen. Gold, therefore, seems to be a metal which is singularly indifferent to oxygen. Before charging the cornettes with carbonic acid or carbonic oxide it was necessary to ascertain that they did not contain any gas in the first instance. But it was found that they really did contain a considerable proportion of what may be called natural gas, which had to be removed from them. This gas amounted to 21·2 per cent. The gold cornettes actually contained twice their volume of natural gas, which consisted chiefly of hydrogen and carbonic oxide, with the exact proportions of which I will not trouble you, and which had been absorbed from the muffle furnace in which the cornettes had been originally heated.

(To be continued.)

ACADEMY OF SCIENCES.

JULY 15, 1867.

(FROM OUR OWN CORRESPONDENT.)

Pre-Newtonian ideas of gravitation.—Marine Engines.—Election of M. Wurtz as a member of the Academy.—Perfluoride of Manganese.—Isolation of fluorine.—Oxychloride of Magnesia to replace Plaster of Paris.

M. CHASLES laid on the table the letters and notes from Pascal alluded to at the last meeting. It is incontestable that in these autographs, the date of which is certainly anterior to 1562, the year of the death of Pascal, the illustrious philosopher speaks of attraction at a distance as well as at the surface of the earth and in the midst of the celestial spaces, and even of molecular attraction, in the same terms as Newton. He makes the same calculation of bodies falling in an orbit, of mass, of distance; he lays down the same laws, &c.

M. Du Puy de Lome made a long and interesting communication on the marine engines of the ship of war Friedland, of the French navy, with three cylinders and of 1000 nominal horse-power, and an effective power of 4000, which will give the ship a speed of fourteen knots an hour with sixty revolutions of the screw per minute.

The academy then proceeded to the election of a member in place of M. Pelouse. The number voting was 53; M. Wurtz was elected with 45 votes against 3 given to M. Berthelot, and 2 to M. Cahours. It is, as we have before stated, almost the unanimity of votes; there were two blank billets, that is to say, that two of the illustrious did not consider MM. Wurtz, Berthelot, and Cahours worthy of sitting beside them, and did not give themselves the trouble of choosing between them. It is melancholy to see academicians imbued with feelings of

such a foolish disdain, or evincing publicly so great a meanness of spirit.

M. Dumas announced that M. Nicklès, of Nancy, had just made a discovery in mineral chemistry by showing how to prepare a combination of fluorine and manganese, which is to the simple fluoride what the binoxide or sesquioxide is to the simple oxide, the protochloride, and the protiodide to the deuto, sesqui, or polychloride, or iodide. M. Nicklès has found that the new combination, deutofluoride, or fluoride of fluoride of manganese, is less stable than the analogous chloride or iodide. Moreover, and this gives great importance to the discovery, the deuto-fluoride will certainly be less stable than the simple fluoride of manganese, and it seems difficult to believe that we shall not one day succeed in decomposing it by heat, or otherwise, into fluorine and fluoride of manganese, under conditions which will permit the fluorine to be isolated, and so fill up a great gap in chemistry.

M. Dumas then called the attention of the academy to a new industry of M. Sarel, which nothing could lead us to foresee, viz., that chloride of magnesium can unite and associate with magnesia or oxide of magnesium to form an oxychloride of magnesium perfectly insoluble and possessing, as does the oxychloride of zinc, in a degree incomparably greater than plaster of Paris, the property of not only taking all variety of forms, but of causing the solidification and taking a high polish of a great number of substances with which it may be mixed, in the proportion of a fifteenth to a twentieth of their weight. Experiments made two years ago leave no doubt on the good quality of stones prepared by this process, and the absolute resistance, of objects so fabricated and moulded, to the deleterious action of water. Industry and art will therefore enter into possession of new elements of construction and transformation. The chloride of magnesium that can be extracted from sea water, or which is found in great quantities solidified in interior seas as that of Stassfurt, does not require to be entirely pure, and costs less than the oxychloride of zinc.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

Manufacture of starch, utilisation of the waste.—Phenic acid its manufacture and properties.

PARIS, JULY 17, 1867.

MORE than 100 tons of wheat are annually employed in the fabrication of starch in France. M. L. Maiche, of Paris, now proposes to utilise the waste as an aliment.

The best wheat only contains 55 per cent of starch, while rice of the most ordinary description contains 85 per cent; maize and buck-wheat also contain a considerable proportion. The difficulty consists in the separation of foreign matters, such as bran, cellulose, gluten, &c., contained in the pulp of the grains. Having isolated small quantities of cellular tissue and other substances, the author found that the specific gravity of these bodies was much less than that of starch.

If raw starch is placed in water, a small quantity of almost pure starch is deposited, but the bulk only falls mixed with the different substances above mentioned; these, although specifically lighter, are relatively more heavy, being much larger than the starch grains. M. Maiche takes advantage of difference of specific gravity, in order to obtain a complete separation; he makes use of centrifugal force, by which the specifically heavier bodies are thrown farthest off. The mode of operation is the following:—A mixture of raw starch and two parts of water is introduced into a sort of drum of copper, turning on its axis at the rate of 1,000 to 1,200 revolutions per minute; as soon as the velocity attains 450 turns, the starch commences to be separated, and collects in a compact mass, adhering to the sides of the vessel; all the

impurities remain in the water, in the centre, which is easily drawn off, while the perfectly white and pure starch can be removed in lumps. All amylaceous matters can be treated by this method, and the extraction of the starch which formerly required several weeks, now takes place in a few minutes. The return is much greater, for 100 kilogs. of rice, costing less than 100 kilogs. of wheat, give more than 20 francs worth of starch. There is then no reason for employing, in the manufacture of starch, wheat which gives the best and most nutritious flour, and the chief principle of nutrition of which, the gluten, is almost entirely lost by the process actually employed.

We give an extract from the excellent lecture given at the Society of Encouragement for National Industry, on *Phenic Acid and its Compounds*, by Dr. Crace-Calvert. It is well known that when coal is heated to a low degree in retorts or distillatory apparatus it gives off substances that can be classed into four groups.

1. Gaseous products furnishing light, heat, and motive power.

2. Water containing ammoniacal salts, which can be purified by well-known chemical means, and utilised in agriculture and in the industrial and medical arts.

3. A thick, black, sticky mass of a repulsive odour, to which the name of *tar* has been given, and which passes over along with the above-named products.

4. A solid porous body, known by everybody as "coke," which remains in the retorts.

When tar is submitted to distillation, first water is obtained, then products which pass over with this liquid, but which, lighter than it, float on the surface, and are therefore termed the *light coal oils*. Lastly, there is distilled a compound heavier than water, and consequently called *heavy oil*.

It was about the year 1837 that these heavy oils were first used for the preservation of sleepers according to Bethell's process. M. Farestier, engineer-in-chief of the department of the Vendée, conjointly with M. Marin, engineer, published a very remarkable and very complete work on the creosoting of wood and its preservation for twelve, fifteen, or twenty years from decay and the ravages of water and the teredo. There remains in the retort a substance fusible at the high temperature attained after the oils have passed over. This is asphalt or bitumen, which hardens on cooling. The distinguished lecturer then proceeded to "phenic acid," stating that M. Laurent, the great French chemist, was the first to indicate the method of extracting phenic acid from tar. It consisted in submitting the light coal oils to a partial distillation, and treating by a concentrated solution of potash, the products distilling at a temperature between 160° and 200° C.

In 1847 Mr. Mansfield indicated another method of treating the heavy oils by caustic alkalies, and towards 1856 M. Bobœuf made known his modified process of M. Laurent. This consists chiefly in the use of caustic soda instead of potash, and treating the whole of the light oils, instead of a portion, by Laurent's method; but this only gave an impure acid, yet, in a commercial point of view, it was a progress. Of a similar nature were the products manufactured by Mr. John Bethell, since 1847, under the direction of Mr. Calvert. They were used for several purposes, either for the production of picric acid, or for transforming tannic acid into gallic acid, or for preserving organic substances from putrefaction. M. Bobœuf used it also very extensively for this purpose.

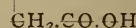
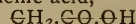
In 1859, M. Marmas, of the firm of Guinon, Marmas, and Bonnet, of Lyons, came to Manchester, and requested Mr. Calvert to furnish a purer picric acid than that hitherto made, showing him, at the same time, a product white and crystalline, which they furnished as a type. Mr. Calvert made new researches, and discovered that the most favourable mode of preparation was not to treat the coal oils with concentrated alkalies; but, on the contrary, to treat impure benzine of commerce, or naphtha, by weak alkaline solutions.

By this means, a blackish semi-fluid product was obtained, a little heavier than water, having a sp. gr. of 1.06, containing 50 per cent of real phenic acid, and which acid he separated partly by the aid of distillation. After further researches, Mr. Calvert produced white phenic acid in detached crystals, melting between 26° and 27°C. Towards the end of last year he discovered a process by which he produces phenic acid free from all unpleasant taste; and what deserves remark is, that it is as pure, though it is made from coal tar, as if it had been artificially produced by the aid of reactions recently discovered by MM. Wurtz and Kékulé.

F. MOIGNO.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Succinic Acid, constitution of.—H. Wichelhaus. (C=12, O=16). While succinic acid, in accordance with its formation from bicyanethylene, has generally been viewed as bicarbethylenic acid,

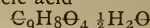


it has been represented recently by Claus (*Ann. Ch. Pharm.* cxli., 49) as bicarbethylidenic acid,

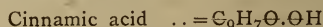


As a necessary support to the latter view, the acid derived by H. Müller from cyanpropionic acid (which was prepared from chlorpropionic ethide) should have been identical with succinic acid. This, however, is not the case; they differ in melting point, solubility, and in their behaviour towards ferric chloride. On the other hand, an acid has been obtained from β chlorpropionic acid (derived from glyceric acid) by the same reaction, that is, treatment with potassic cyanide and decomposition with potassic hydrate, which has the same properties as succinic acid. It would appear, therefore, that β chlorpropionic acid is the starting point for the synthesis of succinic acid, and that the latter must still be considered as bicarbethylenic acid.—(*Zeitschr. Chem.*, N.F. iii., 247).

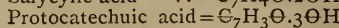
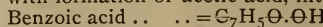
Tannic Acids.—H. Hlasiwetz (C=12, O=16). Caffe-tannic acid, when treated with potassic hydrate, is successively converted into caffeic acid, sugar, and protocatechuic acid. Caffeic acid



is obtained by boiling caffe-tannic acid with a solution of potassic hydrate of 1.25 sp. gr. $\frac{1}{3}$ of an hour. It is then precipitated with sulphuric acid, recrystallised from water, and decolorised with animal charcoal. It is soluble in alcohol; ferric chloride produces in its aqueous solution a green colour, which turns dark red on addition of soda; it is precipitated by plumbic acetate, and converted into oxalic acid by nitric acid. Fused with potassic hydrate, it breaks up into protocatechuic and acetic acid, and dry distillation converts it into pyrocatechin. Treated with sodium amalgam it takes up 2H forming hydrocaffeic acid. Caffeic acid is triatomic, and is the third in the following series:



which, on being treated with fusing potassic hydrate, are converted, with formation of acetic acid, into the series:



The solution from which the caffeic acid has crystallised contains sugar; it is neutralised with potassic hydrate, evaporated and extracted with alcohol. After purification the sugar appears as a syrupy, non-crystallisable mass, showing the usual reactions. An analysis gave the formula, $\text{C}_6\text{H}_{10}\text{O}_4$.

Caffeinnic acid, by its splitting up into caffeic acid and sugar is thus proved to be a glucosid.—(*Akad. Wien. lv. 1867*).

Ammoniacal Platinum Compounds.—T. F. Cleve has given an account of his researches on the platinum-bases, comprising a critical examination of those already known, and a description of many new derivatives of these interesting compounds. For detail, we must refer to the original paper.—(*Bull. Soc. Chim. vii. 12*; or, more complete, *Acta Societ. Scient. d'Uphala*, 1866).

Tea, constituents of.—H. Hlasiwetz and Malin. ($\Theta=12, \Theta=16$). Rochleder states that tannic acid and boeic acid may be obtained from a decoction of tea by precipitation, first with neutral plumbic acetate, and the filtrate therefrom with basic or ammoniacal plumbic acetate. The authors, however, find that both precipitates alike contain tannic, gallic, and oxalic acid; the latter, besides, a small quantity of quercetin,

$C_{27}H_{18}O_{12}$, which imparts to it a yellow colour. If the lead precipitate is decomposed with sulphuretted hydrogen, and the filtrate boiled with dilute sulphuric acid, much more of this body is obtained; from which it appears that the original solution does not contain quercetin in the free state, but probably as quercitrin.—(*Akad. Wien. lv., 1867*).

Aromatic Aldehydes under the Influence of Dehydrating agents.—V. Longuinine. ($\Theta=12, \Theta=16$). Cuminol ($C_{10}H_{12}O$) is powerfully acted upon by phosphoric anhydride, being converted by it into a resinous mass. Zincic chloride is without action in the cold, and almost so at the temperature of the water-bath, but if employed in the fused state, a violent reaction takes place, which results in the formation of Cymol ($C_{12}H_{14}$). The author believes that first the hydrocarbon $C_{10}H_{10}$ is formed, which subsequently combines with hydrogen, resulting from the complete decomposition of a portion of the aldehyde.—(*Comptes*, R. lxiv. 785.)

Argentio Iodide.—H. Fizeau finds that amorphous argentic iodide (prepared by precipitation), like the crystallised and fused modification (CHEMICAL NEWS, No. 386), shows the remarkable phenomenon of contraction with rising, and expansion with falling temperature.—(*Comptes*, R. lxiv. 772.)

Iodine-Starch.—H. Pellet. From experiments made as to the cause of the decolorisation of iodine-starch on heating, and reappearance of the colour on cooling, the author arrives at the following conclusions:—1. Decolorisation is caused by the solution of iodine-starch in an excess of hot starch; the solubility being less in the cold, the colour reappears again on cooling. 2. Iodine-starch is decomposed at $100^{\circ}C$, and iodine volatilises. 3. Iodine-starch remains unchanged in alcohol, being equally insoluble in that liquor whether hot or cold. 4. Iodine-starch may be regarded as a salt, which in certain solvents is more readily soluble when hot, than when they are cold.—(*Bull. Soc. Chim. vii. 147*.)

Ozonometry.—A. Cossa is engaged with experiments, the object of which is to discover an exact method for the determination of ozone in atmospheric air. The author has at present established the following facts:—1. A solution of pure potassic hydrate (free from every trace of organic matter) absorbs nitro-oxygen-compounds without destroying ozone. 2. The quantity of iodine liberated in a solution of pure potassic iodide is in exact proportion to the amount of ozone that has passed through the liquid, and may be accurately measured by means of Bunsen's volumetric liquid.—(*Zcit. Analyt. Ch. vi. 24*.)

Quinine, Testing of.—Stoddart recommends the following methods for testing quinine for quinidine, &c.:—6 grammes of the suspected quinine are dissolved in a test tube in 5 grammes sulphuric acid, diluted with 3 grammes water; to this is added 7.5 grammes ether, 18 grammes alcohol, and 2 grammes of a solution of sodic hydrate containing about 8 per cent. The mixture is well shaken, and left to itself for 12 hours. If quini-

dine, cinchonine, or cinchonidine are present, they will be found in a layer below the ether—quinidine as an oily liquid, cinchonidine in crystals.

The second method consists of a microscopic examination of the crystalline precipitate produced in a saturated and neutral solution of quinic sulphate by potassic sulphocyanide. (10gr. in 45gr. water.)—(*Journ. Pharm. Chim. iv. 50*.)

Ferric Chloride, Volatility of.—R. Fresenius. The author has made a few experiments in order to decide whether any loss is likely to occur in analytical operations through iron being volatilised during evaporation of its solution with an excess of chlorhydric acid. In one experiment he evaporated ferric chloride with chlorhydric acid nearly to dryness; in a second, the evaporation was performed in presence of an alkaline chloride, and the mass afterwards kept on the water-bath for twelve hours; in a third, ferric chloride, with much chlorhydric acid, was kept boiling for $1\frac{1}{2}$ hours. In neither case did any loss of iron take place.—(*Zeitschr. Analyt. Chem. vi. 92*.)

CORRESPONDENCE.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

SIR,—The paper by Mr. Newlands appears to me to be based in great part, if not entirely, on erroneous notions regarding magnetism.

If the distance between the pole of a magnet and a magnetic body is very considerable as compared to the size of the latter, the body will not be attracted, inasmuch as two opposite poles are always produced by induction; and as, under the above conditions, both these induced poles may be regarded as at the same distance from the inducing pole, the one will be repelled exactly as strongly as the other is attracted, the result, as regards attraction, will therefore be *nil*. The distance of the poles of the earth being almost infinite compared to the size of a piece of iron on the pan of our balance, the iron will not be attracted by the magnetic power of the earth, and will weigh as much on the equator as on the poles, subject only to the altered force of gravity.—I am, &c.,

A. D.

VAPOUR DENSITY OF WATER.

To the Editor of the Chemical News.

SIR,—The apparent discrepancy between the two modes of calculating the expansion of water in becoming steam, noticed by Mr. F. O. Ward, in your last number, arises from a slight error in one of the calculations, which should be as follows:—

	Grammes.
2 litres of H at $0^{\circ}08936^{\circ}$ =	... 0.17872
1 litre of O at $16 \times 0^{\circ}08936^{\circ}$ =	.. 1.42976
	1.60848

The 3 litres being condensed into 2, a
litre of aqueous vapour at $0^{\circ}C$. and
760 mm. weighs..... $\frac{1.60848}{2} = 0.80424$

and hence (neglecting the slight expansion of water in cooling from its point of maximum density 0°) 1 litre of water at 0° would become $\frac{1000}{0.80424}$ or 1243.4 litres of aqueous vapour. The steam, however, being formed at 100° , will become expanded to $\frac{373}{273} \times 1243.4$ or 1,699 litres, so that again neglecting the slight expansion of the water

* The weight in grammes of a litre of hydrogen at $0^{\circ}C$. and 760 mm. pressure.—*Roscoe's Chemistry*, p. 19.

in heating from the point of maximum density to 100° , 1 litre of water at 100° becomes 1,699 litres of steam at 100° .

The vapour density of water (observed, air = 1.0000), and the weight of a litre of air at 0° and 760 mm. as given in Cooke's *Chemical Physics*, p. 693, are respectively 0.6235 and 1.29206 grammes; hence the weight at 0° and 760 mm. of a litre of aqueous vapour will be 1.29206×0.6235 , or 0.8056 grammes, which does not differ much from the previous theoretical number 0.80424, and corresponds to an expansion at 100° of 1,696 times, since $\frac{1000}{0.8056} \times \frac{373}{273} = 1,696$.

—I am, &c., CHARLES. R. A. WRIGHT, B.Sc.
Chemical Laboratory, St. Thomas's Hospital,
July 13th, 1867.

To the Editor of the Chemical News.

SIR.—The few editorial remarks which appeared in your issue of the 12th inst., induced me to look over Mr. Ward's statements on the above-named subject. I think I may safely advance that Mr. Ward has erred in this instance to the extent of the difference indicated between his numbers and the experimental results. Adopting the specific weights which he gives for the volume of the water constituents, the weight of a litre of steam at 0°C. , and ordinary pressure, would not be 7.2576 grms, as Mr. Ward states, but 0.8064 grm. It follows, therefore, that a litre of water would produce a volume of steam at 100°C. , which, when corrected to 0° would amount to 1241.3 litres ($\frac{1000}{0.8064} = 1241.3$).

According to Mr. Ward's figures this volume should be 137.77 litres ($= \frac{1000}{7.2576} = 137.77$), although he enlarges the result to 1377.8 litres.

Gay Lussac's experimental determination of 1,700 litres as the volume a litre of water acquires when converted into steam by a temperature of 100° if corrected to 0°C. corresponds very nearly with the volume of 1241.3 litres, for $\frac{1700}{1.3665} = 1244$.

The corrections to 0° cannot make any important difference in the ratios; and I may state that the relation of volumes deduced by theory, or obtained by experiment, would be coincident at any point intermediate between 0° and 100° . So far, therefore, we may believe that perfect harmony exists between the theoretical and experimental results in relation to the expansion of water into steam at 100° .

Indeed, it is beyond my capacity to comprehend how any difference could arise here, between theory and experiment, or that in the entire series of volume-ratios any discord or diversity could be educed under similar or analogous conditions to those referred to.—I am, &c.,

MARTIN MURPHY.

College of Chemistry, Liverpool, 13th July, 1867.

To the Editor of the Chemical News.

SIR,—The assertion that water expands 1696-fold in becoming steam at 212°F. rests on the authority of Gay Lussac, and is a result of direct experiment. He found that 1 c.c. of water gives 1626.4 c.c. of steam measured at 100°C.

Now, 2 litres of H weigh 0.1792
1 ——— O ——— 1.4336

1.6128

1 litre of steam at 0°C. weighs, then, 0.8064 grm. Hence, 0.8064 c.c. water at 4°C. becomes 1000 c.c. steam at 0°C. and 1367 c.c. at 100°C. , or 1 c.c. water becomes 1695.2 c.c. steam at 100°C.

The difference between theoretical and experimental results amounts thus not to 8 per cent, but to 0.08 per cent.

There are three errors in Mr. Ward's calculations, which, however, counteract each other rather curiously.

$$16 \times 0.0896 = 1.4336, \text{ not } 1.4336$$

$$\frac{1000}{7.2576} = 137.78 \text{ not } 1377.8$$

I am utterly unable to understand the method adopted for the correction for temperature. I may remark, however, that the co-efficient of expansion of gases for 1°F. is

$$\frac{1}{491} \text{ and not } \frac{1}{460}$$

and that the correction should be made from 212°F. to 32°F. , and not to 60°F. —I am, &c.,

W. M. WATTS, D.Sc.

Glasgow, July 16th, 1867.

To the Editor of the Chemical News.

SIR,—I observe some calculations under the above heading in this week's CHEMICAL NEWS. If Mr. Ward had made his calculations correctly, he would have had no difficulty in reconciling the fact that water expands 1,696-fold when converted into steam at 212°F. , with the vapour density of water.

It is not necessary to point out all the errors of calculation. The following calculations will show most of them when placed in juxtaposition, and it is only necessary to state that the weights of hydrogen and oxygen are taken from "Bunsen's Gasometry."

	Grammes.
2 litres of H at 0.08961 =	1.7922 at 32°F.
1 litre of O =	1.43028 "
2 litres of water vapour =	1.60950 "
1 litre of do. =	0.80475 "
$\frac{1000}{0.80475} = 1242.6$	

$1242.6 \times 1.3665 = 1698.0$ = volume of vapour at 212°F. from unit of water of maximum density (at 39.2°F.). 1,696 has probably been arrived at by cutting off fractions; by multiplying 1,242 by 1.366 we get 1696.5.—I am, &c.,
D. H.

To the Editor of the Chemical News.

SIR,—In Mr. F. O. Ward's calculation of the vapour density of water a mistake occurs, which, if corrected, will remove the discrepancy noticed by him.

	Grammes.
2 litres H at 0.0896 =	0.1792
1 litre O at $16 \times 0.0896 =$	1.4336
	1.6128

3 litres becoming 2 we have $\frac{1.6128}{2} = 0.8064 = 9 \times 0.0896$ as the weight of 1 litre of steam at 0°C. and 760 mm. pressure. A litre of water weighing 1,000 grammes, at 4°C. or 999.88 grammes, at 0° will therefore give $\frac{999.88}{0.8064} = 1239.9$ litres steam at 0°C. and 760 mm. pressure.

Reducing the alleged 1,696 litres at 100° for temperature, we get $\frac{1696}{1.367} = 1240.6$ litres at 0° and 760 mm. pressure, or almost exactly the theoretical quantity, assuming steam to possess the same coefficient of expansion as atmospheric air, viz., 0.367 between 0° , and 100° , and under constant pressure. The *crith*, it should be remembered, is the weight of a litre of gas or vapour at 760 mm. pressure, and at 0°C. , and not at 60°F. —I am, &c.,
A. D.

VAPOUR DENSITY OF WATER.—"CHEMISTRY OF THE FUTURE."

To the Editor of the Chemical News.

SIR,—I notice, with not unpleasurable surprise, that you have bestowed the honour of publicity on some remarks of mine, not penned with a view to impression, and

wanting, I see, some little revision. They refer to the discrepancy of the figures representing the vapour-density of water, as on one hand deduced from its received volumetric constitution, and as computed, on the other hand, by correcting, for temperature, the ordinary statement of the expansion of water in becoming steam at 212°F ., viz., 1696-fold. The accidental misplacement of a decimal point, and a casual error in the reduction of boiling point to 60°F . have led to the working out of the discrepancy as greater than it really is. I subjoin the corrected figures, from which it will be seen that the discrepancy is still large; leaving me nothing to alter in the remarks founded thereon.

Computing the vapour density of steam from its volumetric constitution, we have:—

2 litres of H = 1 at $0^{\circ}0896$ $0^{\circ}1792$
1 litre of O = $16 \times 0^{\circ}0896$ $1^{\circ}4336$

3 litres weighing $1^{\circ}6128$

These 3 litres being condensed into 2, we have

$$\frac{1^{\circ}6128}{2} = 0^{\circ}8064$$

as the vapour density required. As a litre of water weighs 1000 grammes, its expansion ratio, in becoming steam at ordinary temperature and pressure is obviously

$$\frac{1000}{0^{\circ}8064} = 1240$$

Turning now to the usually alleged expansion-ratio, 1696, and reducing it for temperature, at the rate of $\frac{1}{460}$

per degree F., for the difference between boiling point and $60^{\circ}\text{F} = 120^{\circ}$, we have the ratio

$$\frac{340}{460} \times 1696 = 1253.5656$$

which, set against the above computed $1240^{\circ}0000$

Shows a discrepancy of $13^{\circ}5656$

This is the point to which I called my friends' attention, with reference to the question whether the volumetric relations of bodies are so symmetrical as is our present disposition to suppose.

This touches a subject now strongly attracting the attention of the chemical world—I mean the nature and constitution of matter and the mode to be preferred of conceiving and representing its chemical transformations. With reference to these deeply interesting questions, I will ask your permission to cite here a letter which I received, more than 20 years ago, from Professor Faraday. I was at that time a youth at college, in the first ardour of my scientific studies, and I had devised—as most chemical tyros do, I believe—a fantastical theory of the nature of matter and of the forms and properties of its elementary particles, as also of the building up of these into compound molecules. No doubt I made my acid particles pointed and my sugary and oleaginous molecules round, taking care to provide my atoms with suitable facets whereby to fit one another in the construction of compounds, all which ordinary fluttering of my young chemical wings I must have deemed vastly profound and original, since I posted the paper, with high expectations, for the illustrious professor's judgment.

Two days afterwards I received a letter, on the corner of which I read, with a beating heart, the celebrated philosopher's signature. Being at present far away from my archives, I can but quote this letter from memory, yet I think I can give it you nearly *verbatim*, so profound was the impression made on my mind by its modest simplicity, contrasted with my boyish presumption, and so lasting was the philosophic lesson it conveyed. It ran nearly thus:—

"I have received your ingenious speculations on the nature of matter, and on the forms and properties of

atoms; and, in reply to your question, I have no hesitation in advising you to experiment in support of your views, because, whether they be confirmed or confuted, good always comes of experiment.

"As to your views themselves, and my own opinion on the subject, I am fain to confess that I have thought long and closely on the theories of matter, and on the nature of its particles or atoms; and that, the more I think, in association with experiment, the less distinct does my idea of an atom or particle of matter become."

I have never known which most to admire in this letter—its modest wisdom, or the condescending kindness which prompted its writer to bestow on an obscure youth—to him a total stranger—so gentle yet impressive a monition.

But why is it cited now and here?

Because its marking words—"in association with experiment"—are, if I mistake not, particularly apposite to the present posture of chemical affairs.

The chemical world is, indeed, under invitation to embrace a new theoretic system, which incorporates, as an essential part of its fabric, the affirmation that several bodies, never yet decomposed, are compounds of a known with certain unknown elements; and, further, as regards the known elements themselves, that they are the results, some of one, others of two or more "operations," strangely likened to so many "strokes on a bell."

It would ill befit a mere student, like myself, of some of the simpler parts of chemistry, to criticise proposals brought forward by a recognised master of the science. Yet my admitted inferiority leaves me all the freer to confess that my dim conceptions of elementary matter derive no light from the suggestion that, in a "chemical operation," the evolution of hydrogen is attended, as it were, with *one* sound, and that of oxygen with *two*.

So, again, I may frankly avow that, to me, the proposed substitution of Greek for Roman letters, in our chemical symbols and formulæ, seems likely to impart to our hitherto attractive science, an aspect of abstruseness uncompensated by any *real* addition thereby made to the profundity of our knowledge.

Our real experimental acquaintance with the nature and constitution of hydrochloric acid, for example, remains unaltered, so far as I can see, whether we write it HCl, as of old, or denote it by the Greek symbol, $\alpha\chi$; and, for my own part, I feel the deep mystery of chlorine undiminished, when I am told, as the result of a series of equations, that



Still less, methinks, can the clearness of our physico-chemical conceptions and reasonings be promoted, by the two-fold interpretation which it is proposed to bestow, on the algebraic signs + and -. These, it would seem, we are invited to employ, sometimes in their old accustomed acceptation, sometimes as symbols of differences in "direction;" which differences, an arrow-head turned this way or that, would, I think, much more fitly represent.

By an equally gratuitous confusion of things different, the ordinary collocations signifying in algebra multiplication and division, are to be henceforth employed by chemists, not in those familiar senses only, but also as signs of chemical combination and decomposition. For my part, I must confess that I cannot trace the faintest analogy between the multiplication of one number by another, and the combination of two chemical elements; though here confusion can scarcely be avoided, the algebraists having, unadvisedly as I think, made the mere writing of two quantities in immediate succession the sign of their multiplication into each other. No such necessity can be pleaded to justify the use of the symbolic

grouping $\frac{a}{b}$, heretofore set apart to express the division of one quantity by another, as the sign of so utterly dissimilar a conception as that of chemical

decomposition, which we are, nevertheless, invited to write in much the same manner — putting Cl for H , for instance, to signify the decomposition of hydrochloric acid. If symbols of chemical combination and severance be needed, why not devise some simple forms of expression for the purpose; as, for example, marks of parenthesis, ordinary and reversed, the former for combination— (HCl) , the latter for decomposition— $\text{H}(\text{Cl})$. Surely this, or some equivalent expedient, would be more philosophical than the forcing into an artificial quasi-connexity, of facts and conceptions so utterly incongruous, as to be absolutely incomparable.

I own myself at a loss to discover the additional profundity of reasoning assumed to be derivable from this ambiguous duplication of the meaning of symbols hitherto received, each only in a single sense. This mixing up of algebraic and chemical symbols, so far from assisting ratiocination in either kind, will rather tend, I think, to increase the toil of chemical thought, and to multiply the chances of chemical error, by the additional stress gratuitously imposed on the chemist's attention, thus called on, as it will be, to catch correctly so many alternating modes of interpretation, each in its variable turn.

As for the new "fundamental definition" of a chemical phenomenon, it is "an operation on the unit of space, the result of which is a weight." I confess that, for me, this play of words throws not the faintest ray of light on any of the familiar marvels of chemistry, such as solution, effervescence, crystallisation, explosion, and all the numberless transformations of form, colour, combination, properties, &c., which collectively make up our astonishing science. In what sense is the above definition more luminous, more explanatory of the wonders amidst which we move, than if one should say, conversely, that a chemical phenomenon results from the operation of a weight (or weights) within given limits of space (and time). There is no limit to the multiplication of such abstractions, and if that now propounded gains acceptance, I cannot see why, to-morrow, a new Transcendental school may not be started, with a modified "fundamental definition," declaring a "chemical phenomenon" to be an "operation upon the unit of Time, the result of which is a Force."

Such expressions may be more or less neat and antithetic, but they afford us not the slightest insight into those hidden ways of nature which they affect to fathom and reveal. The *essence* of natural phenomena is, indeed, unknowable; we may study their relations, and ascertain the conditions of their existence, so as to obtain means for their modification and control, but when we seek, with subtle phrases, to express their absolute nature and causation, we do but disguise our ignorance and cheat our yearning curiosity with words. Of such kind appears to be the abstract definition of chemical phenomena now put forward to fit our science for the new analytical method proposed; and unless this apprehension should prove to be ill-founded, the new system will do little, I fear, towards promoting the real inductive progress of chemistry.

Far be it, however, from me to deprecate the introduction into chemical science of any high analytical method, if such there be, really compatible with its eminently concrete and experimental character, and really calculated to support the arduous reasoning of chemists through further-reaching concatenations than have heretofore been possible for them. But no such transcendental methods will avail, unless, as Faraday enjoins, they be used in constant "association with experiment," and due subjection to its wholesome check.

This rule would, I think, be as seriously infringed by the premature acceptance of chlorine, and a series of cognate bodies, as compounds of hydrogen with various unknown elements, as it would have been, if, in Sir Humphrey Davy's time, the suspected composite character of the alkalis had been elevated to the dignity of an estab-

lished fact before its reality had been demonstrated by Davy's ever memorable experiments.

I would not, however, be understood as seeking, by any means, to undervalue or disparage the intellectual power displayed by the eminent propounder of the new doctrine, in his vigorous assault on the so-called "Chemistry of the Past," and equally cogent demonstration of the necessity for a higher and larger "Chemistry of the Future." In this proposition all chemists are, I think, agreed. It has long been felt by philosophical reasoners—Auguste Comte among the number—that the atomic theory fails to satisfy our intellectual requirements, when it is applied to the interpretation of *organic* chemistry, though it has answered its purpose admirably as a means of intelligibly connecting the main facts of *inorganic* chemistry. We, therefore, need a unitary conception, of more comprehensive scope, capable of embracing, under common forms, the facts of both divisions of the science, and adapted to make manifest their intrinsic harmony, not only with each other, but also with the recent developments of physical science, such as, for instance, the lately proved convertibility of motion into force, and *vice versa*.

It is not, therefore, in any captious dislike of innovation, still less in a cavilling or disrespectful spirit, that I have ventured to submit what seem to me objections to the system now proposed. My attitude is rather that of a student who, after a perplexing lecture, lays his doubts, with deference, before his professor. I feel anxious lest chemical philosophy, at this juncture, should be led into a false, though brilliant path; lest, in striving after analytical methods, possibly unsuited to a science so essentially concrete and experimental, we should barter solid facts for metaphysical subtleties, and only, after all, make chemistry more abstract, at the cost of making it less real.

Like my chemical betters, however, I await, before finally judging the new system, its full and complete development; and I shall be found among its first and most grateful devotees, should it open up new spheres of really *positive* reasoning and research, and tend to facilitate (in Faraday's pregnant phrase) "THOUGHT ASSOCIATED WITH EXPERIMENT."

F. O. WARD.

MISCELLANEOUS.

Obituary.—Our readers will probably have already seen the announcement of the death, and have lamented the loss, of Dr. Thomas Richardson. Dr. Richardson was Reader in Chemistry at the University of Durham, as well as a Fellow of the Royal Societies of London and Edinburgh, and member of the Royal Irish Academy. He died somewhat suddenly, at Wigan, on the 10th inst., of congestion of the brain. Of late years Dr. Richardson was best known to the chemical world by his work in connection with "Richardson and Watts' Chemical Technology." Several papers of his are to be found in the volumes of this Journal and the *Chemical Gazette*. They relate chiefly to manufacturing chemistry. Many chemists will have pleasant reminiscences of their visit to the Newcastle meeting of the British Association, and of Dr. Richardson's hospitality on that occasion.

NOTES AND QUERIES.

Vapour Density of Water.—In reference to this subject a correspondent draws attention to a work published many years ago, by order of the French Government, containing the results of the very elaborate researches, made by V. Regnault, on the density, &c., of steam. Our correspondent does not mention the title of the book, but he says that in it the subject mooted by Mr. Ward is fully and conclusively set forth.

* * * Owing to great press of matter, "Notes and Queries" and "Answers to Correspondents" are unavoidably postponed. With reference to Mr. Ward's figures in our last number, we feel it right to mention that we printed them from a private note, evidently written off-hand, and unrevised: as also that the writer's corrected version reached us by the post following that by which the *CHEMICAL NEWS* would come into his hands, and antedated the other letters on this subject. The fact of Mr. Ward's letter following instead of preceding the other letters occurs in accordance with a rule adopted in most printing offices, when there are several communications on the same subject, of placing the shortest first.

THE CHEMICAL NEWS.

VOL. XVI., No. 399.

CHEMICAL PRIZES.

THE custom of offering prizes for the successful solution of problems in chemistry, is one which deserves some attention in this country. On the Continent it is not rare to find chemical manufacturers, or directors of large works where a particular operation in testing or analysis has to be performed many times a day, resort to the expedient of publicly offering a prize for the discovery of a process which shall fulfil certain prescribed conditions. This plan has several advantages. In most large chemical works there is one operation which has to be performed almost hourly, and on the accuracy and dispatch of which much money is risked. It is impossible for any chemist attached to the establishment to be acquainted with all the improvements which are being made in a particular process, and his time is generally too much occupied in routine work, to admit of his carrying out the experiments necessary for the working out of minor details. A publication of the difficulty through the agency of the scientific press, is often sufficient to bring forward many good suggestions, and we can point to our own "Notes and Queries" column in illustration of the readiness with which chemists will assist each other in the elucidation of a technical problem.

This plan, however, of asking for advice is obviously of limited use. Although any of our readers would, we doubt not, be willing to give a querist information when he could do so by simply writing a letter to our columns, few would feel inclined to enter gratuitously into an investigation, and occupy their time for some weeks, to solve a technical problem simply for the benefit of a manufacturing firm. Hence the system of offering prizes appears especially appropriate, and in many instances the expenditure of £50 or £100 has secured to the manufacturer an analytical process which has saved the outlay many times in the year.

A prize of 300 thalers has just been offered by the Mansfeld Copper Mining Company, Eisleben, for the discovery of a process for the estimation of copper in the Mansfeld schist, the following conditions being fulfilled:—The process must not occupy more than five or six hours, including all operations. One person must be able, without much exertion, to finish at least eighteen analyses daily. The differences between the analyses must fall within narrow limits. All the claims for the prize, with full particulars, are to be sent to the Company before the end of December next. The decision will be announced on June 30, 1868, and if any of the processes sent in fulfil the requisite conditions the prize will be forthwith paid, but should several be found which appear eligible, to the best will be awarded 200 and to the second 100 thalers. If, however, no satisfactory process is discovered, it is intended that the prize shall be divided amongst those who have

sent in the best investigations on the subject. The successful processes are to remain the property of the Company.

A few months ago we drew attention to the fact that one of the largest and most extensive manufacturers of tartaric acid would give £100 as a reward to any one who would discover a satisfactory method of determining, directly, the quantity of crystallisable tartaric acid present in tartars, in a sufficiently ready manner to be applicable to commercial analysis; the name of this firm has not been made public, but should any of our readers wish to know more accurately the conditions of the prize, they can address a private letter to our office.

It is, perhaps, not premature to mention that in all probability a money prize will shortly be offered through the CHEMICAL NEWS, for the discovery of a somewhat similar process of technical analysis, connected with an important branch of manufacture. The details are now under consideration.

ON THE RECOVERY OF SULPHUR FROM ALKALI WASTE. By LUDWIG MOND.

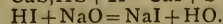
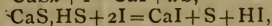
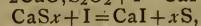
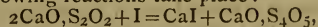
(Concluded from p. 28).

Firstly, I wanted an easy and rapid method of determining the quantity of acid necessary for the decomposition of a given quantity of liquor, which always contains hyposulphite, polysulphide, and hydrosulphide of calcium and sodium. For this end I availed myself of the following method:—

1. The hyposulphite is determined as usual by a standard solution of iodine and starch, after having first separated the polysulphide and hydrosulphide by adding an excess of chloride of zinc, and filtering.

2. To a certain quantity, say 3·2 c.c. of the original liquor, and starch, is added a standard solution of iodine until it turns blue, the liquor is then again decoloured by a drop of hyposulphite of soda solution, and litmus, and a standard solution of caustic soda are added until the liquid is neutral.

The following reactions take place:—



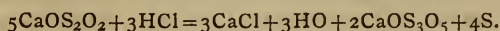
Thus the caustic soda corresponds to the sulphuretted hydrogen, the iodine used in the first titration to the hyposulphite, and from the iodine used in the second titration and the two former numbers the calcium present in the form of sulphide is easily calculated.

Using for both titrations 3·2 c.c. of liquor, and standard solutions containing one-tenth of an equivalent per litre, and presuming that the polysulphide is bisulphide only, we have simply to add the measures of iodine used in both determinations, to subtract the measures of caustic soda, and divide this number by ten, in order to find the total percentage of sulphur in the liquor, from which the muriatic acid is easily calculated, every 32 of sulphur requiring 36·5 of hydrochloric acid.

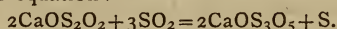
Generally, the polysulphide contains very little more than 2 equivalents of S to 1 of Ca, so that this method is also sufficiently exact for the determination of the sulphur in the liquors, for practical purposes.

Though this method has been proved to be perfectly correct by a number of accurate experiments, the muriatic acid, as calculated by it, was still more than was actually required to effect a complete decomposition of the liquor. A number of careful investigations made with the view of explaining this fact, have shown that, contrary to the assertions of all chemical handbooks, the products of the decomposition of hyposulphite of lime by muriatic

acid are, comparatively little sulphur and very little sulphurous acid, but principal trithionic acid, and a small quantity of pentathionic acid. The reaction was proved to take place principally according to the following equation :—



On boiling, the trithionate of lime is decomposed to sulphate of lime, sulphur, and sulphurous acid. The latter transforms a portion of the hyposulphite, which is still in the liquor, again into trithionate, according to the well-known equation :—

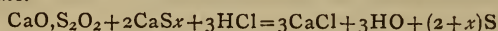


The newly-formed trithionate is again decomposed, and so on. In consequence of these reactions it is possible to decompose a solution of hyposulphite of lime completely into sulphur, sulphate of lime, and very little sulphurous acid, by adding to it when boiling a quantity of muriatic acid sufficient to neutralise about one-half of the lime in solution.

In places where hydrochloric acid has a comparatively high value, these facts may be taken advantage of. As, however, at the present moment, fully one-half of the acid produced by the decomposition of salt is run into the rivers, or passes into the air, and as, besides the above-quoted reactions involve a very heavy loss of sulphur in the form of sulphate of lime, and produce also a very impure sulphur, I prefer the following plan, which avoids these inconveniences.

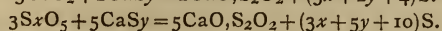
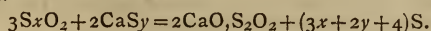
The oxidation of the waste is regulated so as to obtain a liquor, which contains as nearly as possible to every equivalent of hyposulphite, two equivalents of sulphide. This liquor is decomposed by first adding to a certain small quantity of acid an excess of liquor, until there is a trace of sulphide in the mixture; then a quantity of acid sufficient to neutralise the whole of the calcium is poured in, a new quantity of liquor equivalent to this last quantity of acid is added, and then acid again, and liquor again, and so on, until the vessel is nearly filled. To the last liquor only one-half of the required acid is added, and steam introduced, until the liquid shows a temperature of about 140°F. Practically speaking, the liquor and the acid are poured at the same time into the decomposing vessel in nearly equivalent proportions, the workmen taking care to keep a small excess of liquor up to the end of the operation. This part of the process is carried on in wooden tanks covered in and connected to a chimney, in order to carry off any sulphuretted hydrogen which may be evolved by mistake of the workman. If properly carried out there should be, however, no appreciable quantity of that gas evolved.

The practical result of this mode of working is simply precipitation of nearly the whole of the sulphur in a pure state.



The details of the reaction, are, however, very complicated, almost all the different acids of sulphur being probably formed during the process.

In the first place, by adding liquor to acid, some sulphuretted hydrogen is given off (which may be avoided by starting the operation with liquor rich in hyposulphite) and hyposulphurous acid is set free, which will give rise to the formation of sulphurous and several thionic acids. All these are, however, again converted into hyposulphite by the sulphide of calcium in the liquor, then added in excess.



The muriatic acid entering next, thus only produces hyposulphurous acid, and its products of decomposition, which are again converted into sulphur and hyposulphite without the formation of any gaseous product, and so on. At the end there is a certain quantity of hyposulphite left in the liquors, which is decomposed into sulphate and

sulphur by adding an insufficient amount of muriatic acid. In practice about 90 per cent of the muriatic acid, calculated according to the above described method, are required to effect thus the complete decomposition of a well-proportioned liquor. If it contains more hyposulphite than above indicated, less acid is, of course, to be used. About 90 per cent of the sulphur contained in the liquor is precipitated in an almost pure state, and settles exceedingly well within two hours. The supernatant clear solution of chloride of calcium is then drawn off, and another operation directly commenced in the same vessel. As soon as a sufficient quantity of sulphur is collected in it, which will depend on the size of the vessel and on the strength of the liquor (varying from 4 per cent to 7 per cent of sulphur), it is drawn out by means of a door at the lower part of the vessel into a wooden tank with a double floor, where the chloride of calcium is washed out by water, and the sulphur then simply melted down in an iron pot. The product thus obtained contains only from $\frac{1}{10}$ per cent to 1 per cent of impurities, and is thus by far superior to any sort of brimstone in the market, though it has sometimes a rather darker colour caused by traces of sulphide of iron, or a little coal dust, which latter may have been suspended in the muriatic acid.

The total yield of sulphur obtained by the process amounts thus to 10 or 11 per cent of the weight of the salt-cake used in making black ash, or to about $\frac{1}{2}$ of the sulphur therein contained, and to about 60 per cent. of the sulphate contained in the waste. I still hope, however, to be able to increase this quantity considerably by some more years experience. The cost of production, as well as that of the plant, are inconceivable. In the different continental and English works, where the process has now been working for years, the expense for wages, fuel, and maintenance amounts only to £1 per ton of sulphur, and the outlay for the plant has been more than covered by the net profits of the first year.

The two other processes represented at the Paris Exhibition are, as stated, based on the same principle.

M. Schaffner oxidises the waste in heaps, exposing it for several weeks, lixiviates, and repeats this treatment three times. He decomposes his liquor by adding muriatic acid, after having heated it to the boiling point, conducting the sulphurous acid formed into a vessel filled with fresh liquor, and thus producing sulphur mixed with large quantities of sulphate of lime, as above stated. This impure sulphur he refines in a very ingenious way by melting it under water in a closed vessel provided with an agitator, thus obtaining a product of remarkably fine colour and great purity. This process has been adopted in a number of German works. Mr. P. W. Hofmann oxidises the waste by spreading it on a large surface and moistening with a solution of chloride of manganese in order to facilitate the oxidation, which, however, requires some weeks before it is completed. He then lixiviates, and in order to separate sulphur from the liquors so obtained, he avails himself of the muriatic acid contained in the waste liquor of bleaching-powder stills, as has already been proposed by Messrs. Townsend and Walker, in 1860. He mixes these liquors in such proportions as just to saturate the free acid, and thus obtains a product containing about 92 per cent of sulphur. This process is in operation at the alkali works at Dieuze in France.

Besides these, a considerable number of patents have been taken out for inventions in the same direction, which, however, contain no new facts of importance bearing on our subject, and most of which, apparently, have never been worked out.

The most successful of them has probably been that of Mr. Benjamin Jones, a workman who assisted me in working my process out on a large scale in 1863, at the works of Messrs. John Hutchinson and Co., in Widnes. One of the three patents which he took out between December, 1863, and May, 1864, has been worked for a short time in Warrington, but was however quickly abandoned.

ON THE SUPPOSED NATURE OF AIR PRIOR TO THE DISCOVERY OF OXYGEN.

By GEORGE FARRER RODWELL, F.C.S.

(Continued from p. 31).

In the *Philosophical Transactions* for 1686, we find a paper entitled, "An Account of an Experiment shown before the R.S., of Shooting by the Rarefaction of the Air," by Dr. Denys Papin, R.S.S. Otto Von Guericke had previously described a similar invention, but Papin's gun was considered more effective. It consisted of a long tube fitted with suitable valves. It was exhausted by an air-pump, and the external air was suddenly admitted. By this means a bullet weighing two ounces was propelled with great velocity to a considerable distance.

In the *Philosophical Transactions* for October, in the same year, Papin gives "A demonstration of the velocity wherewith the air rushes into a vacuum." The Academie des Sciences had previously endeavoured to determine the relative velocities of air and water under similar conditions, by filling a bladder first with water, then with air, applying a like pressure, and noting the time necessary to empty the bladder respectively. It was thus found that the bladder of air could be emptied in one twenty-fifth the time necessary to empty the bladder of water, and it was hence concluded that with equal orifices and pressures the velocity of air is twenty-five times greater than that of water. But for many reasons stated by Papin this method is most erroneous. The following mode of demonstration was adopted by Papin. It had been proved that the heights to which dissimilar liquids will be driven by the same pressure will be reciprocally as the specific gravity of the liquids; thus a pressure which causes mercury to rise to a height of one foot will cause water under the same conditions to rise to a height of 1×13.5 feet. From Galileo's demonstration that the velocities of bodies are as the square roots of the heights to which they would ascend, it follows that the velocities of two dissimilar liquids is as the square root of their respective specific gravities. Now the pressure of the air is equal to that of a column of water 32 feet high, which would rush out with a velocity of 45 feet per second. The specific gravities are as 840 to 1, and the roots as 29 to 1; therefore the velocity of air is 29 times greater than that of water under similar conditions; hence he concludes that the velocity of air driven by the whole pressure of the atmosphere, or in other words the velocity of air entering a vacuum, would be $45 \times 29 = 1,305$ feet per second.

Papin continued to act as Curator to the Royal Society till the year 1687, when he was appointed Professor of Mathematics in the University of Marburg, an appointment which he held until his death, in 1714.

Although Papin did not do much by direct means to further pneumatics, he did much indirect service to the science by the invention and improvement of apparatus. It is strange that the invention of the double-barrelled air-pump should be so frequently attributed either to Boyle or Hauksbee; the error is probably due, on the one side, to the fact that the first account of it was published in a work which claimed Boyle for its author; and in the second place because it was improved and first perfectly figured by Hauksbee, and by him brought into general use. Winkler* of Leipsic, while he is most cautious to mention the slight improvements introduced by Sengwerdus, Wolfius, Leupold, S'Gravesande, and Muschenbroek, does not so much as mention Papin. The air-pump as Papin found it possessed but one barrel; one at least of its valves was worked by hand; and the receiver had to be cemented to the pump-plate before the commencement of each experiment. As he

left it, it possessed two pump-barrels, fitted with self-acting valves; a ground pump plate upon which a receiver with ground edges could remain air-tight without the necessity of cement; and a connection was established between the pistons, so that the descent of one effected the elevation of the other.

We can scarcely be surprised that Papin did not greatly extend our knowledge of the nature and properties of the air, for the above extracts from his works clearly show us that his object was to apply the air-pump to useful purposes, rather than to extend pure pneumatical research. He was prouder of his "Digester of Bones?" than of his double-barrelled air-pump; and he preferred the experiments on the preservation of fruits, to the "demonstration of the velocity wherewith the air rushes into a vacuum."

We may mention *en passant*, that Papin was one of the first to adopt the important theory of combustion (since completely verified), of "Ce très subtil Anglois M. Robert Hook," as he calls him.

ON THE QUANTIVALENCE OF CHLORINE AND OTHER REPUTED MONADS.

By JOHN A. R. NEWLANDS, F.C.S.

THE difficulties with regard to the formation of certain compounds, which have been lately pointed out by Dr. Odling and others, seem to indicate that chlorine and other reputed monads must really possess latent bonds, and be capable of acting as triads, &c., under peculiar circumstances. Thus, in the union of ammonia and hydrochloric acid the nitrogen acts as a pentad, and, if we regard the hydrogen and chlorine in hydrochloric acid as monads, the hydrochloric acid must be decomposed in order that its hydrogen and chlorine may unite with nitrogen, an element for which they have but slight affinity. On the contrary, if we admit that chlorine may act as a triad (just as iodine does in ICl_3), we may suppose that two of its bonds are latent in H Cl, and that on bringing HCl in contact with NH_3 the two latent bonds of the Cl unite with the two latent bonds of the N. Or, we may suppose that the Cl in HCl remains a monad, and that the H acts as a triad having two latent bonds, which on the approach of NH_3 serve to unite it with the two latent bonds of the N. This latter view of the constitution of sal-ammoniac, and similar bodies, is, perhaps, preferable, as it represents the H of the HCl as directly united to the N of the NH_3 .

It may be said that if this view holds good regarding the union of HCl and NH_3 , it ought to hold good with regard to the union of ethylic iodide, $\text{C}_2\text{H}_5\text{I}$, with NH_3 , and that either the I or one of the five atoms of H in the ethylic iodide acts by virtue of two latent bonds, and so unites itself with the two latent bonds of N in NH_3 .

For the purpose of the present communication, I admit, in accordance with the views of Frankland and others, that multivalent elements may have their apparent quantivalence reduced by successive pairs of bonds becoming latent. Thus N is a pentad in NH_4Cl , a triad in NH_3 , and a monad in ON_2 , and C is a tetrad in CH_4 and a dyad in CO, still N is always a perissad and C always remains an artiad.

These views, however, may be extended by considering it possible for a monad, by the development of two or more pairs of latent bonds, to become a triad, a pentad, a heptad, &c., still, however, remaining a perissad. In like manner, we may consider it possible for a dyad, by the development of two or more pairs of latent bonds, to become a tetrad, a hexad, an octad, &c., still, however, remaining an artiad.

So that all perissads may really have the same number of bonds (that number being an odd number), and may differ only by the number of pairs of latent bonds which their atoms respectively possess, under ordinary circum-

*Vide his *Aufangsgrunde der Physic*. Leipsic, 1754, translated into English in 1757.

stances. Again, all triads may really have the same number of bonds (that number being an even number), and may differ only by the number of pairs of latent bonds which their atoms respectively possess under ordinary circumstances.

Thus I, which is a monad in KI, becomes a triad in ICl_3 ; B, which is a triad in BF_3 , becomes a pentad in BKF_4 ; Pt, which is a dyad in PtCl_2 , becomes a tetrad in PtCl_4 , and an octad in PtK_2Cl_6 ; and Si, which is a tetrad in SiF_4 , becomes an octad in SiK_2F_6 .

In the following table certain compounds of the monads with O, &c., are given, which are analogous to the compounds of triads and pentads placed alongside of them. I am aware that too great stress must not be laid upon such facts, inasmuch as the number of atoms of O combining with an element, affords us no absolute proof of its quantivalence:—

H_2O	..	Cl_2O	..	K_2O	..	N_2O
H_2O_2	..	K_2O_2	..	N_2O_2		
Cl_2O_3	..	N_2O_3	..	P_2O_3		
Cl_2O_4	..	K_2O_4	..	N_2O_4		
I_2O_5	..	N_2O_5	..	P_2O_5		
KClO_2	..	KNO_2				
HClO_3	..	HIO_3	..	HNO_3	..	HPO_3
ICl_3	..	PCl_3				

This table might easily be enlarged to a considerable extent, but I think the above will be sufficient to render the view probable that reputed monads may, under certain circumstances, play the part of triads and pentads. This is certainly the case with I in ICl_3 , and the privilege we accord to I we cannot well refuse to Cl, Br, or even to H itself.

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ON THE UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 32).

III.—COAL TAR.

This is a very complex liquid, for it contains at least three classes of compounds—viz., acids, neutral bodies, and alkaloïds, the composition and leading properties of which are as follows:—

Acids of Coal Tar.

Names.	Formulae.	Specific Gravities.	Boiling-points (Fahr.)
Acetic	$\text{C}_4 \text{H}_4 \text{O}_4$	1062	243°
Butyric	$\text{C}_8 \text{H}_8 \text{O}_4$	973	314
Carbolic	$\text{C}_{12} \text{H}_6 \text{O}_2$	1065	370
Cresylic	$\text{C}_{14} \text{H}_8 \text{O}_2$	—	397
Phlorylic	$\text{C}_{16} \text{H}_{10} \text{O}_2$	—	424
Rosolic	$\text{C}_{24} \text{H}_{12} \text{O}_6$	—	—
Brunolic	?	—	—

Neutral Bodies of Coal Tar.

Alliatus oils ..	?	?	?
Benzole	$\text{C}_{12} \text{H}_6$	850	177
Toluole	$\text{C}_{14} \text{H}_8$	870	230
Xylole	$\text{C}_{16} \text{H}_{10}$	867	264
Cumole	$\text{C}_{18} \text{H}_{12}$	870	299
Cymole	$\text{C}_{20} \text{H}_{14}$	861	341
Naphthaline ..	$\text{C}_{20} \text{H}_8$	1153	428
Anthracine ..	$\text{C}_{28} \text{H}_{10}$	1147	572
Pyrene	$\text{C}_{30} \text{A}_{12}$	—	?
Chrysene	$\text{C}_{24} \text{H}_8$	—	?

Basic or Alkaline Bodies of Coal Tar.

Pyridine	$\text{C}_{10} \text{H}_5 \text{N}$	986	242
Pyrrrol	$\text{C}_8 \text{H}_5 \text{N}$	1077	272
Picoline	$\text{C}_{12} \text{H}_7 \text{N}$	961	271
Lutidine	$\text{C}_{14} \text{H}_9 \text{N}$	946	310
Collidine	$\text{C}_{16} \text{H}_{11} \text{N}$	937	354
Parvoline	$\text{C}_{18} \text{H}_{13} \text{N}$	—	370

Aniline	$\text{C}_{12} \text{H}_7 \text{N}$	1080	360°
Toluidine	$\text{C}_{14} \text{H}_9 \text{N}$	—	388
Xylidine	$\text{C}_{16} \text{H}_{11} \text{N}$	—	418
Cumidine	$\text{C}_{18} \text{H}_{13} \text{N}$	952	437
Cymidine	$\text{C}_{20} \text{H}_{15} \text{N}$	—	482
Chinoline	$\text{C}_{18} \text{H}_7 \text{N}$	1081	462
Lepidine	$\text{C}_{20} \text{H}_9 \text{N}$	1072	510
Cryptidine ..	$\text{C}_{22} \text{H}_{11} \text{N}$	—	525

The general properties of coal tar, as well as the proportions of its several constituents, vary with the quality of the coal used, and with the temperature at which it is distilled or carbonized. The tar which is produced from common gas coals at rather high temperature is always heavier than water (sp. gr. 1.120 to 1.150). It dries freely in the air, and its hydrocarbons are so rich in carbon that the tar cannot be burnt in an ordinary lamp. But the tar which is produced from cannel coal at lower temperatures is lighter than water, and does not readily dry when it is exposed to the air. Besides which, its hydrocarbons are comparatively poor in carbon, and may be burnt in lamps. There is almost every variety of coal tar from these two extremes, but the tars of commerce are chiefly of three kinds—viz., the rich cannel coal tar of Scotland; the tar which is produced from common coal in country gas-works, where the temperatures are generally low; and the still heavier tar of the London gas-works, which is produced at excessively high temperatures. The yield of tar per ton of coals is from 9 to 15 gallons—the latter being the average at country works; and the former, or from that to 10 gallons, is the yield in London, where the tar is undoubtedly affected by the high temperature of the retorts, for it is not only small in quantity, but it is deficient of naphtha, and contains more pitch than country tar; besides which, the dead oil from it is always overloaded with naphthaline.

In London the distillation of coal tar is always effected in stills, which are placed over a fire, and the products are collected at different stages of the distillation. Up to a temperature of from 160° to 190° Fahr. little or nothing flows over, but at that temperature ammoniacal liquor, with *crude naphtha* of a gravity of 850, begins to distil. These continue to flow until the thermometer rises to from 310° to 340°, when a heavier naphtha of a gravity of about 920 is carried over. This is called *light oil*, and it is collected separately until the temperature rises to from 370° to 400°, and then the oil begins to have the gravity of water; after that, and up to the temperature of from 690° to 700°, the oil which is collected is heavier than water, and is therefore called *heavy oil* or *dead oil*—the last runnings having a gravity of 1060 or thereabouts. If a soft pitch is wanted the process of distillation is stopped at this stage, but if a harder pitch is required it is pushed a little further, and the *green oil* which flows over is rich in neutral oils, which are well suited for making railway grease.

A still containing 2,500 gallons of coal tar will in this way yield about the following proportions of the several products:—

Ammoniacal liquor	from 50 to 70 gals. (average)	60 gals.
Crude naphtha ..	30 " 50 " "	40 "
Light oil	12 " 35 " "	30 "
Creosote or dead oil	689 " 740 " "	720 "
Pitch	8 " 10 tons "	9 tons.

Each of these products has its commercial value, the naphtha and light oil being used for the production of benzole and toluole of commerce—naphthas which are largely in demand for the manufacture of coal-tar colours.

Formerly the greatest value was attached to the naphtha or benzole which had a low boiling-point, and the contracts, especially with the French, were for a benzole or naphtha which yielded 90 per cent of volatile oil at a temperature not exceeding 212°, and I have examined thousands of gallons of this quality for the French market. Even at the present time there is a demand for

this, which is called 90 per cent benzole, for making certain aniline reds; and to obtain it the crude naphtha, or the first runnings from the tars, were distilled alone. At present, however, there being a demand for a less volatile oil, the practice is to mix together the crude naphtha and the light oil, and to subject them to fractional distillation, thus:—Steam is blown into them at a pressure of from 20 to 30 lbs. on the inch, and the naphtha which comes over with the steam is called *once run naphtha*. This is purified by shaking it with strong sulphuric acid (sp. gr. 1.845), using the acid in small proportions at a time, for fear of injuring the naphtha, and washing with water between each operation. In this manner, after using about 5 per cent of acid (or $\frac{1}{2}$ lb. to each gallon of naphtha), the brown colouring matter of the naphtha and all basic compounds are either destroyed or removed, and the brown naphtha, after being well washed with water, is again distilled by blowing high-pressure steam into it, and the products are collected at three stages; that which comes over first is called *crude benzole of 80 per cent strength*, the second runnings are a naphtha containing 50 per cent of benzole, and the third is a naphtha which is used for solvent purposes. With the view of strengthening the 50 per cent benzole, and making it 80 per cent, it is redistilled from a vessel with a steam jacket, whereby the temperature can be regulated. That which flows over at a temperature up to 210° is set aside as 80 per cent benzole; that which distils between 210° and 260° is called 30 per cent naphtha; and the residuum, on being treated with high-pressure steam yields *solvent naphtha*. Once more the 30 per cent naphtha, or that which has flowed over at from 210° to 260°, is distilled with a dry steam heat, and when the thermometer has risen to 106° there is obtained a little more 80 per cent benzole; after which, and up to 234°, there flows over what is called 40 per cent naphtha, and from 234° to 260° a little of the 30 per cent. Steam is then blown into it, and it yields a little more of the solvent naphtha.

In this way, by a series of fractional distillations, the washed naphtha is made to yield at each successive operation a quantity of 80 and 40 per cent naphtha. All the 80 per cents are then mixed together, and are once more distilled by a dry steam heat. The naphtha which flows over at a temperature up to 204° is called 90 per cent benzole; that which flows between 204° and 210° is called 80 per cent benzole, and is again fractionally distilled up to 204°; while the residue, on being treated with high pressure steam, yields a quantity of 40 per cent naphtha.

Five separate products are thus obtained—namely, 90 per cent benzole, 40 per cent benzole, solvent naphtha, the last runnings of the first operation, and the residuum of each distillation. Operating in this manner with a charge of 1,587 gallons of crude naphtha and light oil, there is first obtained 897 gallons of once run naphtha and 56 gallons of the last runnings, the remainder (634 gallons) being a residuum of no value except for mixture with dead oil; and the 897 gallons of once run naphtha yields, after it has been purified with sulphuric acid, 301 gallons of 90 per cent benzole, 195 gallons of 40 per cent 237 gallons of solvent naphtha, 12 gallons of last runnings, and 152 gallons of residuum.

The 40 per cent benzole contains also 50 per cent of volatile oil, chiefly toluole, which distils over between 212° and 248°. This is the oil which is preferred at the present time for the manufacture of coal-tar colours. The several products which are thus obtained in the distillation of coal tar are upon the table before you, and roughly speaking, the proportions per 10,000 gallons of crude tar and their commercial values are as follows:—

40 per cent. benzole	..	34.4 gals.,	worth 2s. 4d. per gal.
90 per cent. "	..	53.1 "	" 2s. od. "
Solvent naphtha	..	41.8 "	1s. 9d. to 2s. "
Last runnings	..	12.0 "	" os. 9d. "
Dead oil	..	301.87 "	" os. 1d. "
Pitch	..	36 tons	" 45s. od. per ton.

Before rectification the crude naphtha is worth about 1s. per gallon, and the light oil about 6d., the two together fetching 9d. or 10d. a gallon; and once run naphtha is worth 1s. 6d. a gallon. Two samples of this oil from different distillers yielded by fractional distillation the following per centage of proportions of oil at different temperatures:—

	Sample 1.	Sample 2.
Up to 212° Fahr.	 15.0	 17.5
From 212° to 248°	 44.0	 42.0
" 248° to 264°	 8.0	 8.5
" 264° to 300°	 13.0	 13.0
" 300° to 320°	 5.5	 4.5
Residuum	 14.5	 14.5
	100.0	100.0

The samples, therefore, in commerce from good markets may be regarded as of pretty uniform quality.

In Scotland the method of distilling coal tar is a little different from what it is in England, and this arises from the circumstance that the Scotch cannels yield a tar which is so rich in the volatile naphthas that it is not altogether safe to distil the tar from a still with a naked fire. The tar, therefore, is first submitted to the action of high-pressure steam, which is blown into it until the more volatile products are passed off. In this way from 7 to 13 per cent of *crude or rough naphtha* is obtained with a gravity of about 930. The residuum is called boiled tar, and is distilled with a naked fire. It thus yields from 6 to 7½ per cent of a *light oil* called *pitch oil* or *torch oil*, which has a specific gravity of from 973 to 976. The next runnings, which amount to from 27 to 30 per cent of the boiled tar, are generally heavier than water, and are called *heavy pitch oil*, and they constitute the great bulk of the product.

The several products of coal tar are thus used in the arts:—

Coal tar is itself employed as a rough varnish for iron, and in Scotland the *boiled tar* is extensively used for covering woodwork, &c.

Light oil and *crude naphtha* are either redistilled for procuring benzole and toluole, as I have already explained, or they are employed for making common black varnish, or for burning in naphtha lamps. In this country they are for the most part distilled, but in Scotland they are largely used in a lamp called the *foundry lamp*. It is an enlarged form of a lamp which was patented many years ago by Mr. Beale, and it consists of a chamber supplied with naphtha, and having a nozzle or jet for directing a blast of air through it. The chamber is covered with a bell with a large hole in the top of it. When the naphtha is lighted and the bell put upon it, the blast of air forces the vapour of the burning naphtha through the hole in the top of the bell, and thus produces an enormously large volume of flame. The light is equal to at least a dozen gas-jets, and the cost of it is said to be a penny a night. It is very generally used in the foundries, the ship yards, and other large workshops of Scotland.

Solvent naphtha is a colourless spirit which is chiefly employed for dissolving india-rubber for waterproofing, and resins or pitch for varnishes.

The *last runnings* are also used for varnishes, for making a superior lamp black called *spirit black*, and for burning in Holliday's lamp, which is the common naphtha lamp of the streets. It is an ingenious contrivance for converting the naphtha into vapour by means of a mass of heated metal and spreading it out in a star-like form.

I have already alluded to the use of coal naphtha as a means of increasing the illuminating power of common 12 or 14 candle gas, and have shown that with a moderately good naphtha, which yields about seven grains of vapour to every cubic foot of gas, the illuminating power may be increased about 60 per cent. Considering that

naphtha is now becoming a drug in the market, from the waning of fashion in respect of coal-tar colours, it may be worth while to encourage its use as a naphthaliser, rather than to yield to the public clamour for cannel gas. I have long thought that gas, as well as water, should be dealt with at the consumers' houses, when in either case it is required to be of unusual quality.

The *creosote*, or *dead oil of coal-tar*, is used almost entirely for the preservation of timber, and at the present moment, in the stagnant condition of railway business, it is almost unsaleable. I apprehend, however, that it is valuable as a fuel, and that it will ere long be used in steam furnaces. Already there are several patents for its application in this manner, and experiments are now being conducted at Woolwich with the view of ascertaining its practical and economical capabilities. The contrivances which appear to offer the largest prospects of success, are those which deliver the oil into the furnace in the form of a spray or vapour, by means of a jet of steam or blast of hot air; and it is said that the heating power of the oil is from $2\frac{1}{2}$ to 3 times that of a similar weight of coal.

In applying the oil to the preservation of timber, it is necessary that it should be forced deeply into the tissue of the wood. The method employed by the best operators is to place the timber in large wrought-iron cylinders, and then to exhaust it of air and moisture as completely as possible by creating a vacuum. After a time the dead oil, heated to a temperature of 120° Fahr., and thus made as fluid as possible, is let into the cylinder. Pressure is then put upon it until the oil is forced into the wood with a power of 150 lbs. upon the inch. In about three hours the wood absorbs the prescribed amount of creosote, which, with the best houses, is never less than from 30 lbs. to 50 lbs. of creosote to a load of 50 cubic feet of timber; every cubic foot of timber has, therefore, taken up from 6 lbs. to 10 lbs. of oil.

The preservative power of the dead oil is partly due to the antiseptic properties of the creosote, and partly to its filling up the pores of the wood with an oil which gradually resinifies and excludes air and moisture. Different views are entertained of the quality of creosote which is best suited for this purpose. In the contracts which I have prepared for the Indian railway works, I have prescribed that the creosote should have the following properties:—"It should have a density between 1.045 and 1.055; it should not deposit any crystalline matter at a temperature of 40° Fahr.; it should yield not less than 5 per cent. of crude carboic acid to a solution of caustic potash of the density of 1.070 (14° Twaddle); and it should furnish 90 per cent of liquid oil when distilled to the temperature of 600° Fahr." The contracts, which I have lately seen, for the Dutch Government, prescribe that the creosote shall be clear, and shall not deposit more than 40 per cent of naphthaline when cooled to the temperature of 32° , and kept at that temperature for 24 hours. Here are specimens of creosote from country tar which fully realise those properties; but this sample from London tar is almost solid at 32° .

Another use to which dead oil has lately been put is the preparation of a dip for washing sheep. It was patented by Mr. M'Dougall in 1860, and is made by heating together two parts by weight of dead oil with one of a solution of caustic soda of 50° Twaddle (sp. gr. 1.250), which contains about 15 per cent of soda; and to this is added one part of tallow, fat, or other saponifiable substance. The mixture which is thus obtained has the appearance of a very dark soft soap, and it is either smeared upon the skin of the animal, or dissolved in water and used as a wash.

The *greasy matter*, or *green oil*, which follows the dead oil in the distillation of coal tar, is used for making railway grease, with resin, oil, &c.; and the pitch which is the residual product of the distillation is largely employed for all sorts of purposes.

(To be continued.)

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

Group V.—Class 44 : Chemical and Pharmaceutical Products.—Numbered 7 in the English catalogue (8 in the *Catalogue Général*), we find "Borwick, George, 34, Chiswell Street, London. Baking powder, chemicals, spices, &c.," and we are also referred to p. 132 of the appendix for further details. What can induce anyone to exhibit baking powder we are really at a loss to imagine. It certainly is not a subject of any scientific interest, it is not a novelty, it is not interesting in appearance; its mere physical character offers no guarantee of its purity, and, in fact, its negative qualities preponderate so largely, that positively we are astonished that its exhibitor did not (like a great firm of blacking manufacturers) obtain a medal. And yet this baking powder, so insignificant in appearance, so uninteresting in a scientific point of view, so unfit, therefore, for exhibition, is, measured by a commercial standard, of far more importance than many objects that rivet our attention by their beauty or scientific interest. We have been credibly informed that a fortune has been made by its sale.

Then what is this baking powder out of which fortunes have been, or are to be made? Of the composition of the powder of Borwick we know nothing, but Cooley's powder is as follows:—Tartaric acid, $\frac{1}{2}$ lb.; bicarbonate of soda and potato farina, or British arrow-root, of each $\frac{3}{4}$ lb. (each in powder); separately dry them perfectly by a very gentle heat, then mix them in a dry room, press the mixture through a sieve, and at once put into packets, observing to press it hard, and to cover it with the foil or close-made paper, to preserve it as much as possible from the air and moisture. Delfort's formula principally differs in the addition of *alum*! and carbonate of ammonium. With the addition of a little turmeric the compound becomes the "Egg powder" so often seen in the windows of grocers and oil-men. These mixtures are used in domestic economy as substitutes for yeast in bread and butter in pastry, and are in their way, and in their proper places, useful, although humble adjuncts to the *materia* (may we not say *medica*), of the non-professional cook. There is no doubt that by enabling pastry to be made equally light, and with one-third less butter, the better class of baking-powders have prevented many a bilious and dyspeptic attack.

Mr. Borwick, in addition to his baking-powders, exhibits what he terms "ozonized cod-liver oil." We are sorry to find cod-liver oil "repeating" itself in our notices of the chemical and pharmaceutical products in the French Exhibition, but we will not prevent the unsavoury nature of the subject to turn us from our duty. We consider "ozonized cod-liver oil" to be the greatest of the many delusions connected with this useful food—for food it is purely and simply, and the sooner medical men understand its true character the better for their patients.

Mr. Borwick's prospectus states that the impregnation of cod-liver oil with ozone is for the purpose of "conveying artificially to the lungs of the delicate and consumptive, without the effort of inhalation, and in larger proportions than found in the atmosphere, this extraordinary life-giving agent." The prospectus concludes with the following somewhat rash paragraph: "In fact, it is now proved beyond doubt, that ozone is to the weak, delicate, and consumptive, what quinine is to those who are affected with fever—the nearest approach to a specific yet discovered." The italics are those of Mr. Borwick.

Now, it appears to us that this prospectus has certain points of resemblance to the three incompatible pleas anent the cracked pot, viz.: "1st, that it was cracked when we borrowed it; 2nd, that it was whole when we returned it; 3rd, that we never had it at all." For, in the first place, a distinguished chemist who purchased some

and examined it, came to the conclusions—1st, that it did not convey ozone to the lungs of the delicate and consumptive; 2nd, that, if it did, it was not “to the weak, delicate, and consumptive, what quinine is to those who are affected with fever; and, 3rdly, that it did not contain ozone at all.” It is really inconceivable how any one with even a smattering of chemical knowledge could imagine even if the oil *did* contain ozone that it would carry it to the lungs. The trifling fact that the oil has to be digested before it can enter the blood seems to escape the believers in this so-called remedy. That certain oils acquire powerfully oxidizing properties on exposure to light and air we admit, but it must be remembered that in all cases yet known the active oxygen attacks the *oil itself* as soon as the temperature is raised, and may even attack other oxidizable substances present at the same time. The most remarkable instance of the oxidation of essential oil, is, undoubtedly, that of isoprene*; but when ozonized isoprene is distilled (although it boils at about 40°C.) the ozone present attacks the isoprene with violence, and converts it into an oxidized substance. We think, moreover, with the observer of that reaction, that it is doubtful if the oxygen in what we have hitherto termed ozonized oils is really in the state of ozone. The phenomena attending the passage of ozone through tubes of caoutchouc seem to indicate the impossibility of ozone existing (as such) in the presence of oxidizable organic matters.

Even if we admit that consumptive patients are better in an atmosphere which indicates the presence of ozone (or what is assumed to be ozone) what does that really prove? It seems to us rather to show that consumptive people are better when the air is free from the impurities incompatible with the presence of ozone, than that the ozone itself is beneficial to them. The reaction indicated by ozone test papers is not the measure of the total quantity originally in the air, but of the residue left after the destruction of the impurities. But enough of this, we trust that the time is fast approaching when medical men will know more, and talk less, about oxygen and ozone. If one did not hear it so often, it would seem impossible, that in these days of education, doctors are still found who tell their patients to go to the sea-side, “where there is *more oxygen* than in the close and confined streets of towns.”

The British Sea-weed Company (Limited) Whitecrook Chemical Works, Dalmuir, Glasgow, have an interesting collection illustrating Mr. Stanford's process of treating sea-weeds.

When sea-weed is incinerated in the usual way a great loss of iodine is experienced, amounting, it is said, to no less than half. Mr. Stanford, by distilling the weeds in iron retorts, entirely prevents this loss, and obtains, in addition to a valuable series of products of destructive distillation, a charcoal which, after lixiviation, is well adapted for the purposes for which animal charcoal is generally used. Indeed we are informed that the carefully prepared charcoal, from certain varieties of weed, actually exceed in bleaching power the best animal charcoal to be found in commerce. The extreme porosity of sea-weed charcoal is greatly in its favour for bleaching and deodorising, in fact, so readily does it allow even thick syrups to pass, that the filters seldom or never become clogged, if properly arranged. They exhibit three different kinds of this charcoal; No. 1 from “Tangle” is intended for sewage filtration and as a deodoriser; No. 2, from Bardarrie, is at present sold for bleaching; and No. 3, from Black Wrack, is proposed for sugar-refining.

The Company also exhibit iodine, bromine, and potash salts, the latter extracted from the charcoal remaining in the retorts after the distillation is finished. There is also sufficient nitrogen in the sea-weed to yield enough ammonia to figure as an element in the profits of the undertaking. Whether the oils and tar shown are of sufficient

value to be of importance in a pecuniary point of view we are not aware. We should like to know whether a *thorough* scientific examination of the acid, basic, and neutral products of the destructive distillation of sea-weed has yet been made, as it would be very interesting to compare them with those from wood coal and especially peat.

It is highly satisfactory to find that the process which was considered by the jurors of the Exhibition of 1862 as sufficiently hopeful and ingenious to deserve a medal, is now carried to a successful issue under the superintendence of its inventor.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON SPECTRUM ANALYSIS,

WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

LECTURE IV.

Spectra of the Fixed Stars.—Mode of observation.—Double Stars.—Variable Stars.—Temporary Bright Star in Corona.—Nebulæ.—Clusters.—General Conclusions.

In the last lecture I gave you some account of the solar spectrum, and stated some of the principal facts which were revealed to us by its examination. You will remember that in the solar spectrum there are a great number of lines produced, as we now know, by absorptive action in an atmosphere which surrounds the more intensely luminous portion of the sun. We have learned to interpret many of these lines, and we have found that in a great number of cases they are produced by the presence of elementary bodies, known to us upon the earth, which, in the gaseous state, exert an absorptive action upon certain parts of the sun's rays. We have learned, also, that there are certain bodies which are not present in the sun—among them gold, silver, lithium, and several others. But there are still a great number of lines of the nature of which we know nothing. Many, no doubt, will be explained as we proceed further with our investigations into the spectra of terrestrial elementary bodies. Notwithstanding the efforts that have been made within the last few years, our knowledge of terrestrial spectra can be at present considered to be only in its infancy. We can not know what elements, indeed, are still existent upon the earth. We can not be supposed to have come to the end of our knowledge upon this point, for within the last five years no fewer than four of these elementary substances have been discovered by the simple application of this method of spectrum analysis.

The investigation of the solar spectrum, difficult as it is, is one considerably favoured by certain circumstances. We are not limited by season, or the angular altitude of the sun, but can pursue the investigation whenever the sun shines. Moreover, we can command any amount of light which the eye can bear. We can, therefore, by the action of an almost unlimited series of prisms, dissect and open out that solar spectrum, and so scrutinise, with minute accuracy, the position and character of every line which it contains.

I have to-day to refer to other sources of light which may be analysed in a similar way, but the study of which presents difficulties of no ordinary character. I propose to explain some of the methods which have been adopted for the examination of stellar spectra, and to state the chief results obtained by that examination, and I shall conclude by giving you some account of the remarkable and unexpected results obtained by a study of some other still fainter objects which are visible in the heavens—the nebule.

* Phil. Trans. 1860.

It may be necessary for me to give you some notion of the kind of difficulties with which we have to contend in these enquiries, in order to explain how it is that the results, important as they are, are still very imperfect. Solar light, as I have said, may be obtained in unlimited quantity; but when we examine the spectra of the stars we have to deal with points of light. We must collect the light, therefore, and for that purpose either a large reflector or refractor is necessary. Cumbersome machinery is required for moving the tube to enable it to follow the motions of the star, which is apparently perpetually shifting its place in the heavens. We have to bring this light to a point by means of our lenses. The more accurate our telescopes the more exactly is this light brought to a mathematical point. Now, if we attempt to analyse by means of a prism a point of light like this, we shall spread it out into a line, but that line will be so exceedingly narrow that we shall not be able to trace across it the lines of which we are in search, and which are to speak to us of its nature. The first thing, therefore, we have to do, after we have obtained our point of light, is to open it out into a line. That may be done, as was practised by Fraunhofer, by means of what is known as a *cylindrical lens*. I shall endeavour to throw upon the screen a little point of light, which you may, if you please, for a moment consider to be a star, and will then elongate its image into a line of light.

[A circular spot of light was projected upon the screen, and then by means of a cylindrical lens expanded into a line of light.]

Though I can imitate a star in the exceeding minuteness of its light, I, unfortunately, cannot imitate it in the quality of its light, and, therefore, on this occasion, I shall not be able to show you the spectra themselves, but I shall have recourse to photographs from careful drawings made upon the observations of the stellar spectra. In the observations from which these drawings were made an achromatic object glass of eight inches aperture was used, and the observations were made at the observatory of Mr. Huggins, at Tulse Hill, where he and I worked together for some years upon stellar and planetary spectra, and where he has since still further added to our knowledge by his examination of the nebulae.

Having obtained our line of light, the next thing is to project it upon a suitable instrument for making the observations, and this line of light must be kept absolutely steady at the end of a tube ten feet long, upon a slit, the width of which is not more than the sooth part of an inch, or much finer than any ordinary hair. Obviously this can be obtained only by an exceedingly smooth motion maintained by the clock movement of the telescope.

Here is a star spectroscope in the form which, after many trials, we found to be most convenient for these observations. I am indebted to the kindness of Messrs. Simms for the loan of this beautiful instrument, which they are going to send to Professor Cooke, in America. I am also indebted to Mr. Browning for the opportunity of showing you another instrument intended for Mr. De la Rue, which is, in some respects, even better for our purpose, because it enables us to see the parts of which it is composed. This instrument of Messrs. Simms is provided with shutters, so as to exclude dust and other sources of injury to the prisms within. When in use the spectroscope is attached to the eye-end of the telescope, instead of the ordinary magnifying power, and will be carried round with it, accurately following all its motions. The cylindrical lens is placed between the object-glass and the slit, so that the light, instead of falling upon the slit as a point, shall fall upon it as a line, such as I just now showed you, only much more definite than the line which was projected upon the screen. The line of light having fallen upon that slit, is then passed through an apparatus precisely similar in principle to the spectroscope which we examined in the last lecture.

The light of the star is brought to a focus by the action of the object-glass of the telescope itself, exactly at the spot

occupied by the slit of the instrument. But before reaching that spot, it passes through the cylindrical lens, by means of which it is spread out into a line, instead of a point. After passing through the slit, the light falls upon a collimating lens—that is to say, upon a lens the object of which is to bring all the rays that fall upon it into a parallel direction. The rays rendered parallel next fall upon a couple of prisms—the first prism dispersing the light to a certain extent, and the second dispersing it still farther, and producing a spectrum of the star, the most refrangible end being that which is most turned from the original direction. The spectrum then falls upon the lens of a small telescope, by means of which the image can be viewed at the proper distance. The object of the screw beneath the tube is to enable us, by a regulated movement, to carry round the small telescope, so that each part of the spectrum can be successively examined. There are cross wires in the telescope, so that, on bringing any of the lines in the star spectrum one after the other upon the cross wires by the micrometer screw, the distance between the lines may be measured exactly.

The object which we had in view in these investigations was not merely to ascertain that the lines existed in the stellar spectra, for that had been done by Fraunhofer, Donati, Secchi, and others, but to determine what these lines represented—to ascertain the constituents of the stars if possible; and that could be done, approximately at least, by measuring the position of each of these lines, and then comparing it with a map in which the lines of certain metals had been laid down, these metals having been examined by the same instrument as that which was to be applied to the stars. This, however, although it would give a result which was very valuable to us as suggesting what probability there was that certain metals were present in these stars, did not give us that absolute certainty respecting the nature of the substances which it seemed it was possible to attain by another mode of experimenting. That mode consisted in reflecting into the instrument the light produced by a series of electric sparks sent through wires of different metals in succession. In order to attain this object we have attached to this instrument a means of producing sparks between two points of silver. The instant that this circuit is included between the terminals of the secondary wire of an induction coil, a torrent of electric sparks passes between the two silver points. The light is reflected from a mirror, by which it is thrown, through an opening in the side of the tube, upon a little prism which acts as a reflector, and sends the light through the slit into the spectroscope for examination. In this way various stars can be submitted to experiment, but it is obvious that even here, although we have at command a large instrument, we are limited by the brightness of the stars. We cannot examine with any degree of precision stars which are below a certain magnitude, the quantity of light being too small. I shall endeavour to show you the results of the most accurate observations we have been enabled to make. Amongst these stars there are two in particular which are of special interest. These two are Aldebaran, the bright, reddish star in Taurus, and α Orionis, or Betelgeux, the principal star in Orion. Here is a list in which are mentioned certain elementary substances, all of which have been found to produce lines coincident with certain lines in this star Aldebaran:—

Sodium,	Bismuth,
Iron,	Antimony,
Magnesium,	Tellurium,
Hydrogen,	Mercury.
Calcium,	

There is not merely the coincidence of a single line in each case, for that might be an accidental circumstance, but the principal bright lines in each spectrum produced by these bodies have corresponding black lines in the spectrum of this star. You see that there are here nine of the substances known to us upon the earth. By similar means we ascertained the absence of certain other bodies;

these have no coincident lines in the star spectrum. Among these are nitrogen, tin, lead, cadmium, lithium, cobalt, and barium. We have ascertained not simply what are there, but what may not be there. Of the lines which are contained in this star we measured no fewer than seventy, notwithstanding the faintness of the object. Actual measurement, however, is possible only with a certain number of lines. There are an indefinitely greater number of lines existing in the spectrum of the star, many of which might possibly be measured by the devotion of still more time and application.

These observations are excessively fatiguing to the eye, and require special conditions of the atmosphere. A clear night, which would be very favourable to observations made simply with the telescope, might not be suitable for observations with the spectroscopic. The slightest flicker or tremor in the atmosphere disturbs the accuracy of the observation. It must be remembered that we are not observing approximative coincidences, but we are desiring to observe absolute coincidences—coincidences between the bright lines of the metals we have on the earth and the black lines in the spectrum of the star.

In α Orionis we measured eighty lines, and amongst these we find that six of the metals of the earth had lines coincident with those in this star, viz.:—sodium, iron, magnesium, calcium, bismuth, and thallium (?), and that a still larger number were not coincident.

I shall project upon the screen a representation of the spectra of these two stars. They will both be visible together. The upper spectrum is that of the star in Orion, the lower one that of Aldebaran.

Beneath each diagram a number of bright lines may be seen. These represent the bright lines produced by causing sparks to pass between points of different metals attached to the coil. For example, here we have a line marked Sn. This is one of the lines indicating tin, but it has no corresponding line in the star, though we were able to measure within 500th of an inch, or the 1800th part of the length of the entire spectrum, the coincidence between two lines. Here are the three lines of magnesium which have corresponding lines in the spectrum of this star. Here is the double line D in the sodium spectrum. That is a bright double line corresponding perfectly with two black lines in the star. Sodium is one of the most widely diffused substances in the stars; magnesium and iron are also present in both these stars. The lines in this photograph only extend to a certain distance into the blue. Here is the line *b*, and this is the line F, which is upon the margin between the green and blue. Note in passing that there is no line corresponding to F in the star α Orionis. There is a strong line corresponding to it in Aldebaran, but no line in the other. This line F is one of those due to hydrogen. I carry you to another—near the end of the red. Now this line in the spectrum of Aldebaran is a marked line corresponding with Fraunhofer's solar line C. That line also occurs in the spectrum of hydrogen. There are three lines in the spectrum of hydrogen—C, F, and G; but the point of interest here is that none of these lines are present in the star α Orionis, and we conclude that there is no hydrogen there. Besides these are a large number of other lines, some of which are interpreted, others still await interpretation.

We are not yet able to explain in the case of these stars, any more than in that of the sun, what every line indicates. It may very well be that many of these lines are caused by substances which are known to us, but of the spectra of which we are still ignorant; in other cases it may well be that they are produced by substances which are not known to us, and which have no existence, indeed, upon our planet. Amongst the substances which are present in the atmosphere of these stars, are some which are present in our own sun. In other instances, as in the case of bismuth, metals are found in these stars which furnish lines which are not present in the atmosphere of the sun. Both in Aldebaran and in α Orionis there are

lines corresponding with those of bismuth. Tellurium appears to be an important element in the absorbent atmosphere round Aldebaran. Then there are also in the atmosphere of this star substances such as antimony and mercury, which we consider to be poisons. Here is the bismuth spectrum thrown upon the screen. Though not so striking as that of some other metals, its characters are sufficiently strong to enable us to pronounce with certainty upon the presence or absence of lines corresponding with this substance in any star with which its spectrum is compared.

(To be continued.)

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Absorption of Carbonic Acid by Oxides.—J. Kolb finds that the anhydrous and monohydrated oxides of potassium, sodium, magnesium and barium, like calcic oxide, do not increase in weight when exposed to dry carbonic anhydride, but absorption takes place if the latter is charged with moisture. — (*Comptes*, R. lxiv. 861.)

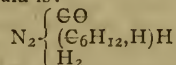
Ozone, Density of.—T. L. Soret. Having previously found that the density of ozone is $1\frac{1}{2}$ times as great as oxygen, the author now applies the method of diffusion as a control of his former observations.

Under similar conditions, in one case, a known mixture of chlorine and oxygen, in another a known mixture of ozone and oxygen were diffused into pure oxygen. The velocity with which chlorine and ozone passed through the diaphragm was in the ratio:—

Chlorine ..	227	= 8382
Ozone ..	271	

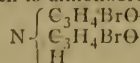
This value approaches closely that of the inversed proportions of the square-roots of their respective densities, taking that of ozone as $1\frac{1}{2}$ that of oxygen, i.e. = 8243. — (*Comptes* R. lxiv. 904.)

Pseudo-hexylurea.—T. T. Chydenius. This compound is prepared by heating pseudo-hexylic iodide (obtained from mannite) with argentic cyanate to 50°–60° C. The reaction is violent, and a liquid strongly affecting the eyes, and possessing a very disagreeable odour, distils over. An excess of ammonia is added, and the solid mass, thus formed, recrystallised from water. Pseudo-hexylurea crystallises in white needles which are readily soluble in hot water, ether, and alcohol, melt at 127° C., and boil, with partial decomposition, at 220°. Its formula is:



When heated with a strong aqueous solution of potassic hydrate in sealed tubes, decomposition sets in at 230°–250°, ammonia being given off, and an oily liquid formed, which probably is isopropylamine. — (*Comptes*, R. lxiv. 975.)

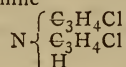
Nitriles, action on Bromine of.—C. Engler. Propionitrile and bromine combine when heated together, forming bromhydrate of propionitrile, $\text{NC}_3\text{H}_5\text{Br}_2$. The body is very deliquescent, fuses at 64° C. and begins to sublime, with partial decomposition, at 72°. It will be seen that bromine in this case acts differently from chlorine, the latter producing, as is well known, dichloropropionitrile, $\text{NC}_3\text{H}_3\text{Cl}_2$. Water decomposes the bromhydrate to bromammonium, bromhydric acid, and a new body which is dimonobromopropionamid.



This latter compound is obtained in white crystals which are soluble in alcohol and ether, almost insoluble in cold water, fuse at 148° C., and decompose at 152°. Aqueous potassic hydrate decomposes the amide with

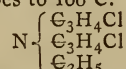
formation of a new acid, the argentic salt of which has the composition $\text{C}_5\text{H}_9\text{AgO}_3$. Dimonobrombutyramide, $\text{N}(\text{C}_4\text{H}_6\text{BrO})_2\text{H}$, is prepared in the same way as the propyle-compound, which it resembles closely.—(*Ann. Chem. Pharm.* cxlii. 65.)

Trichlorhydrin, Action of Ammonia on.—C. Engier. Dimonochlorallylamine



is formed by digesting trichlorhydrin with alcoholic ammonia under pressure at 130° — 140°C . It is a heavy oil, sparingly soluble in water, soluble in alcohol and ether; it decomposes partially on distillation, the portion, analysed, went over between 185° and 195° . The salts of this base are deliquescent, and difficult to obtain in crystals from an aqueous solution. The platino-chloride is readily soluble in water, moderately so in alcohol, and nearly insoluble in ether. It has the composition $\text{N}(\text{C}_3\text{H}_4\text{Cl})_2\text{H}_2\text{Cl}_2\text{PtCl}_2$.

An ethyl-substitution-compound of dimonochlorallylamine is obtained by heating the latter with ethylic iodide in sealed tubes to 100°C . Its composition is



It differs but little from the original compound.—(*Ann. Chem. Pharm.*, cxii., 77.)

Analysis of Organic Compounds, New Method of.—A. Mitscherlich. Of this new method of analysis, which is applicable to all organic, and many inorganic compounds, and which includes the direct determination of oxygen, we can only indicate the principle, as it would be impossible in these few lines to give, without pictorial illustrations, an intelligible description of the complicated apparatus and manipulations required.

1. Oxygen and hydrogen are determined together by heating the substance in a current of chlorine, passing the products of combustion over red-hot charcoal, and absorbing the chlorhydric acid, carbonic anhydride, and carbonic oxide formed by a saturated solution of plumbic nitrate, a solution of potassic hydrate, and a solution of cuprous chloride in chlorhydric acid respectively.

2. Chlorine, bromine, iodine, and sulphur are determined simultaneously with carbon and nitrogen, by volatilising the substance in a current of hydrogen, burning the mixed gases and vapours with oxygen, removing the water by means of sulphuric acid, and collecting the products of combustion in weighed vessels—with the exception of nitrogen, which is measured. The products of combustion, besides the water, may consist of carbonic anhydride, chlorhydric acid, bromine, iodine, sulphurous acid, sulphuric acid, and traces of brom- and chlorhydric acid. A residue of carbon also may be left in the combustion-tube. The water is absorbed by sulphuric acid, the chlorhydric acid by plumbic nitrate, bromine by mercuric oxide, iodine is weighed as such, sulphurous acid is absorbed by potassic bichromate, carbonic anhydride by potassic hydrate, nitrogen is measured, and the residual carbon weighed.

The specimens of analysis given, prove that very accurate results may be obtained by this new method.—(*Pogg. Ann.* cxxx. 536.)

Qualitative Analysis without using Sulphuretted Hydrogen and Ammonic Sulphide.—E. Zettnow. The author tests an aqueous solution, which may contain all of the more common bases, with the following reagents in succession:—

1. Chlorhydric acid precipitates lead, mercury, and silver.

2. Sulphuric acid precipitates lead, barium, strontium, and calcium.

3. Baric hydrate sets free ammonia, the filtrate is used for the detection of sodium and potassium.

4. Zinc is added to the filtrate from 2, the hydrogen ignited and tested for antimony and arsenic; antimony,

arsenic, tin, mercury, copper, cadmium, and bismuth are precipitated.

5. Baric carbonate precipitates from the filtrate from 4, iron, chromium, and aluminium.

6. Ammonic carbonate, after removal of the baryta, precipitates from the filtrate of 5, manganese and calcium; the filtrate is tested for magnesium, cobalt, and nickel.

7. Zinc is tested for in the original solution.—(*Pogg. Ann.* cxxx. 324.)

Reagent for Nitric Acid.—C. D. Braun. A very delicate test for nitric acid is, according to C. D. Braun, aniline sulphate. Half a c.c. of a solution of the aniline-salt is added to one c.c. of pure, strong sulphuric acid, contained in a watch-glass. A glass-rod is then moistened with the liquid to be tested, and moved about in the aniline mixture, when a red coloration indicates the presence of nitric acid.—(*Zeit. Analyt. ch.* vi. 71.)

CORRESPONDENCE.

VAPOUR DENSITY OF WATER.

To the Editor of the Chemical News.

SIR,—I have read with much interest the five communications called forth by some remarks on the vapour density of water, extracted by you from a letter of mine to a private friend.

It is curious to note the little discrepancies which occur in the computations of so many able and learned men applying their minds to the same subject.

On one point the five letters supply these different figures:—

*80424 *80475 *8056 *8064,

of which the last-named has the support of the majority, and is the figure at which I had previously arrived.

On another point I gather these figures:—

1239.9 1240.6 1241.3 1242.6 1243.4—

my own figure, independently calculated, being 1240.

On the question of the true gas-expansion ratio, touched by one of your correspondents, and lying at the very root of the matter, I happen to have a paper at hand, giving the results arrived at by several eminent authorities, and showing notable discrepancies between them, even as to this fundamental datum. These ratios are as follows, for the volume at zero F.:—

Dalton and Gay Lussac..	..	..	..	..	..	1240
Regnault ..	..	..	..	..	..	1238
Magnus ..	..	..	..	..	..	1236
Rudberg ..	..	..	..	..	..	1232

Correcting these ratios for the volume at freezing-point, they become:—

Dalton and Gay Lussac..	..	..	..	..	..	1230
Regnault ..	..	..	..	..	..	1228
Magnus ..	..	..	..	..	..	1227
Rudberg ..	..	..	..	..	..	1224

Applying the first and last of these ratios to the question in hand, and taking $\frac{1000}{8064} = 1240$ as the standard

for comparison (my own computation whereof is sanctioned by the majority of your correspondents), we have, according to Dalton and Gay Lussac—

$$\frac{480}{660} \times 1696 = 1233.45$$

and, according to Rudberg:—

$$\frac{494}{674} \times 1696 = 1243.06$$

On comparing each of these results with our above-mentioned standard, deduced from the volumetric composition of water, we obtain, as the respective discrepancies, the values 6.55 and 3.06; the former being below and the latter above the standard; so that the discrepancy between the two results themselves is the sum of the amounts above stated, viz., $6.55 + 3.06 = 9.61$.

Neither of these discrepancies, however, is so large as that worked out by me in my last letter—into which, I must own, that error crept, through my using (in the absence of my books of reference) an imperfectly remembered rule of computation.

If lastly, we work out the calculation as before, substituting Regnault's ratio, we obtain

$$\frac{490}{670} \times 1696 = 1240.3582$$

which differs from the standard by only 0.3582.

The question therefore turns, so far as the greater or less discrepancy is concerned, upon the relative merits of the respective determinations, by the eminent authorities quoted, of the expansion ratio for gases: as also, upon the more or less thorough soundness of the laws laid down as governing the expansion of gases, one or two of which laws, if I remember rightly, rest partly on assumption.

Meanwhile, though we are free to regard the discrepancy under consideration as larger or smaller, according to the expansion ratio on which we elect to rely, science as yet affords no absolutely certain proof, entitling any one to deny its existence.

The observed and calculated vapour-densities of many other bodies, besides water, show also (unless my memory betrays me) fractional differences more or less important, the very smallest of which may have a real existence, and may exercise more influence than is yet suspected on the play of chemical phenomena. This was the special consideration I addressed to my friend—supporting it by an example drawn from water, and an analogy supplied by music. In the carelessness of intimate pen-talk, I inadvertently made out the discrepancy cited too great; and this, not only as regards the fact itself, but also as regards the fitness of the illustration to my argument. For I was really referring to minute, not considerable differences; and my example is rendered all the more apposite by the correction now supplied.

The want of symmetry established, by Stas, in the ponderal relations of matter, lends colour, I think, to the hypothesis, that a like condition may attend its cognate volumetric proportionalities; for, that these relations should be all absolutely integral, while so many of the others are fractional, seems to me a somewhat hazardous assumption.

In these musings, however, I carefully avoid affirmation; I merely ponder and surmise. Such unripe germs of thought are fitter, no doubt, for the commerce of friends than for the wider public audience, which accident has, in this instance, afforded to mine. If your favour, Sir, have, as I fear, given them more prominence than they deserve, I can only hope that, by stimulating thought, or, still better, by suggesting experiment, they may pay for the time and space they have occupied.

To your able correspondents, whose courteous indications have afforded me much light, I beg, in conclusion, to offer my best acknowledgements, and I remain, &c.,

F. O. WARD.

North Wales, July 20th, 1867.

MISCELLANEOUS.

The Water we Drink.—The Registrar-General in his weekly report says, that on the intermittent system of supplying, the pipes are often left empty, and in that case sometimes get saturated with impurities. This happened in Portland-road, where analysis detected sewage contamination in the water drawn from the stand pipe on June 1st: the sewage was equivalent to 1 per cent of the water, which was turbid when drawn, and, after standing a few days, emitted an offensive odour, and threw down flocculent matter.

University of London.—Science Examination.—Results.—FIRST B. Sc.—1st Division: Bottomley, Carey, Gum, Harding, Hopkinson, Robinson, Tilden, Wormell. 2nd Division: Ball, Brice, Bright, Graham, Leonard, Pearsall, Sheldon, Thorp, Whipple.

SECOND B.Sc.—1st Division: Exall, W. H. (King's College); Payne, J. F. (St. George's Hospital); Smith, R. S. (King's College).

2nd Division: Duer, S. (private study); Ridge, J. J. (St. Thomas' Hospital); Robinson, E. (Owen's College); Sprengell, J. C. F. L. (private study); Waller, A., B.A. (St. Thomas' Hospital); Wigner, J. M. (private study).

HONOURS.—Exall, W. H., second class; Chemistry.

PREL. SCIENT. M.B.—1st Division: Aveling, Ball, Barff, Bruce, Burn, Carter, C.H., Elkington, Gibbings, Harris, J. A., Harris, M., Haynes, Hunt, Saunders, Wall. 2nd Division: Bindley, Burgess, Carr, Carter, A. H., Cotterill, Coupland, Cross, De Méric, Edwards, Fox, T. C., Franklin, Graham, Herman, Ingoldley, Jones, T., Lowe, Lyell, Male, Paget, Perkins, Pippette, Puglie, Ralli, Rayner, Rowland, Rugg, Simon, Sloman, Smith, Southee, Taunton, Waddy, Willaus, Williams.

Experiments on the Poison of the Cobra-di-capella.—The *Melbourne Argus*, for April 26th, contains an interesting article, by Dr. G. B. Halford, on the above subject, from which we extract the following:—"The melancholy accident which so lately happened with the cobra-di-capella induced me to make some experiments and observations upon the action of the reptile's poison. When a person is mortally bitten by the cobra-di-capella, molecules of living 'germinal' matter are thrown into the blood, and speedily grow into cells, and as rapidly multiply; so that, in a few hours, millions upon millions are produced at the expense, as far as I can at present see, of the oxygen absorbed into the blood during inspiration; hence the gradual decrease and ultimate extinction of combustion and chemical change in every other part of the body, followed by coldness, sleepiness, insensibility, slow breathing, and death. The cells which thus render in so short a time the blood unfit to support life are circular, with a diameter on the average of one seventeen-hundredth of an inch. They contain a nearly round nucleus of one two thousand-eight-hundredth of an inch in breadth, which, when further magnified, is seen to contain other still more minute spherules of living 'germinal' matter. In addition to this, the application of magenta reveals a minute coloured spot at some part of the circumference of the cell. This, besides its size, distinguishes it from the white pus or lymph corpuscle. Thus, then, it would seem that, as the vegetable cell requires for its growth inorganic food and the liberation of oxygen, so the animal cell requires for its growth organic food and the absorption of oxygen. Its food is present in the blood, and it meets the oxygen in the lungs; thus, the whole blood becomes disorganised, and nothing is found after death but dark fluid blood, the fluidity indicating its loss of fibrine, the dark colour its want of oxygen, which it readily absorbs on exposure after death. It results, then, that a person dies slowly asphyxiated by deprivation of oxygen, in whatever other way the poison may also act, and so far as the ordinary examination of the blood goes, the *post-mortem* appearances are similar to those seen after drowning and suffocation. I have many reasons for believing that the *materies morbi* of cholera is a nearly allied animal poison. I hope also to show the presence of the poison of our snakes in the blood of bitten and inoculated animals, and to make some experiments on the possibility of saving life.

Behaviour of Manganese with Chlorate of Potash before the Blowpipe.—If chlorate of potash be heated by means of a blowpipe, in a tube closed at one end till oxygen is evolved, and then a trace of manganese added, the potash salt will assume a purple colour, owing to the production of permanganate of potash. This reaction of manganese is quite as delicate as the one proposed by Berzelius.—T. Landaner.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. April 15 & 22, 1867.

H. FIZEAU "New Observations on Iodide of Silver."—A. SECCHI "Note on the Spectra of the Stars." "On the Transparency of Red-hot Iron."—V. LOUGUININE "Action of certain Substances having a powerful Affinity for water on some aromatic Aldehydes." BERTHELOT "Method for reducing and saturating Organic Compounds with Hydrogen."—DUSART "Preparation of Phenols." TRESCA "On the flow of Solids under heavy Pressures."—T. S. HUNT "On the Formation of Gypsums and Magnesium Lime Stones."—P. GAUCHLER "Theoretical and practical Researches on the Flow and Motion of Water."—T. RICHTER "On Indium."—BERTHELOT "Method of reducing and saturating Organic Compounds with Hydrogen."—A. PERROT "On obtaining High Temperatures by the Combustion of a Mixture of Illuminating Gas and Air."

April 29.

BEQUEREL "On the Causes of Rain."—T. S. HUNT "Some Reactions of Magnesia Salts, and on Rocks containing Magnesia."—COUVENT DES BOIS "On the Determination of the South Magnetic Pole."—NAQUET "On the Principles of Chemistry according to Modern Theories."—CHACORNAC "Resumé of a Memoir on the Solar System."—L. CALLETET "On a Process of Gilding and Silvering by means of Sodium Amalgam."—H. DEVILLE "On the same Subject."—L. DUSART "Contributions to the knowledge of Phenols."—J. KOLB "On the Absorption of Carbonic Acid by some Oxides."—P. P. DEHERAIN "Experimental Researches on the Use of Potash Salts in Agriculture."—C. MENE "On Yellow and White Iron Pyrites."

May 6.

E. CARRE "On some new Refrigerating Apparatus."—J. L. SORET "Researches on the Destiny of Ozone." (Second Part.)—F. P. LE ROUX "On the Cause of the Undulations produced in Metallic Wires by the Electric Discharge."—E. JUNGFLIEH "On some Points of Relation between the Melting Points, Densities, and Specific Volumes of some Chlorinated Derivatives of Benzene."

NOTES AND QUERIES.

Sulphate of Magnesia.—A subscriber wishes to know the name of a firm in the North of England who makes sulphate of magnesia by the process described in our journal of April 12th.

Origin of the word Naphtha.—Sir, I have been trying to trace the origin of the word naphtha, but have not succeeded. Can any of your readers tell me where it was first used to designate an inflammable liquid coming out of the ground?—F. PETERSON.

Papering Damp Walls.—Sir, If your correspondent of last week, R. A. Dudley, will get some of the water-glass or soluble silicate of soda advertised in your columns, and brush the dilute solution several times over the damp wall, allowing it to soak in and dry between each application, he will effect a cure.—E.

Manufacture of Sulphuric Acid.—Sulphurous acid, in presence of much water, reduces binoxide of nitrogen to oxide of nitrogen. Can any of your readers kindly inform me what strength the chamber should work to prevent this. I am working two chambers connected. I should also be glad to know what quantity of nitrate of soda is required to make 20 cwt. of sulphuric acid sp. gr. 1.750.—CHILD.

Plaster of Paris.—I should feel obliged to any of your correspondents who would inform me whether there is any way of causing plaster of Paris to set perfectly hard, so that it cannot be scratched by the finger-nail. I have tried the plan recommended in *Muspratt's Chemistry*, page 462, but do not find it to succeed.—A WORKING POTTER.

Making Pyrogallic Acid.—Sir, Will any one inform me whether a method has been published whereby pyrogallic acid can be made in the wet way from gallic acid. The process of sublimation usually adopted is tedious and uncertain. Some years ago a variety of pyrogallic acid in hard prismatic crystals was introduced in photography; this was evidently crystallised from an aqueous solution. Query—Was it sublimed first and crystallised afterwards, or was it not rather prepared in the wet way?—I. COUPER.

Iron made Red-hot by Hammering.—Sir, In answer to "Septic" (CHEMICAL NEWS for June 21st), I beg to state that it is a common thing for a good blacksmith to hammer a horse-shoe-nail red-hot upon a common anvil. I have seen it done by one Jesse Stubbs repeatedly, who informed me, that "years ago when he was a lad," it was not an uncommon thing for a journeyman blacksmith on applying for work, to have to prove himself a good hammerman by making a nail red-hot in as few a number of strokes as possible. I once produced a blacksmith and anvil at a lecture, before the Royal Literary Institution of Hull, when the man made the nail glow before the audience by hammering it. Old blacksmiths in the country say that, before the days of Congreve, Letchford, or Bryant and May, they many a time lighted their forge fire of a cold morning by means of a nail made red-hot by converting motion into heat, or as they term it, "a few sharpish taps" with a hammer. Let "Septic" go to a large blacksmith's shop and offer a shilling to every man who will hammer a nail red-hot, and unless blacksmiths have degenerated during the late severe winter, he will soon part with his money.—J. W.

Mercerising Cotton.—Sir, There is no doubt that Mr. Mercer's discovery, mentioned in your number for July 12, is a valuable one, and were the objections to it more generally known, some of your talented readers might succeed in overcoming them. The advantages are that the fabric contracts about one-fifteenth linearly in each direction and the threads appear rounder, firmer, and closer together; the cloth does not reflect so much white light, but has a translucent appearance. Its strength is also improved; cotton thus treated shows a superior affinity for some colours, especially indigo blue; it takes as deep a shade of blue in one dip as common cloth takes in six, and, generally speaking, colours look better on this than on untreated cloth. The objection to the process was mainly the expense of the soda, but now that this agent has been reduced in price this objection will not be so formidable. It was also said that the appearance of greater fineness and closeness, produced by the contraction of the fibre, could be more surely and economically produced by the loom.—F. OGLEVIE.

ANSWERS TO CORRESPONDENTS.

Errata.—Page 15, line 16 from the top, for carbonate of soda, read carbonate of ammonia; page 27, line 2 from the bottom, for 1863, read 1836.

B. H. A.—Nitrite of amyl may be prepared by passing nitrous vapours into amyl alcohol contained in a heated retort, rectifying the distillate, and collecting apart the portion which goes over at 90 deg. C.

James P.—Your problem in hydrostatics fails in one important requisite: you have forgotten to allow for the force of gravitation.

A. L. S.—It would be a breach of confidence to impart the information, even if we possessed it.

Bartum.—Your communication is declined with thanks.

Medicus.—One of the best hæmostatic agents is said to be a mixture of perchloride of iron and common salt, dissolved in water. No free acid must be present.

M. Kestner.—The best examination of the fixed line D of the solar spectrum was given with a diagram, by Professor Cooke, in our number for July 4, 1863. The drawing shows eight sharp lines, and a nebulous band between the two constituents of D.

Junior Student.—The diaphanometer is an instrument proposed and employed by Saussure for measuring the transparency of the air. Its action was very imperfect, and any variation in the acuteness of the observer's sight would vitiate its results.

A. B.—There is no danger. Push the heat as far as you can.

J. C. B.—If you doubt the statement, come and see the books at our office. Or, should you prefer it, a clerk shall call on you with the printer's delivery ticket for the number printed.

Zena.—Don't be misled, the book is a very good one.

W. Thomson.—Silver solder is best for uniting steel together. Make it by melting together 19 parts of silver, 1 part of copper, and 1 part of brass. Use borax as a flux.

C. Chase.—You had better consult a solicitor. We would rather not advise in such a case.

Dyer.—Stannate of soda is now generally employed. See if your sample contains tungstate of soda. The stannate contains 9 equivalents of water of crystallisation. It is efflorescent in a dry atmosphere.

Foreign Science.—Up to the time of going to press we have not received the Abbe Moigno's letter, nor the proceedings of the *Académie des Sciences* for Monday last.

D. Waldie.—Our correspondent's communication is received with thanks. We shall always be pleased to hear from him.

Communications have been received from J. Ilif; T. Sterry Hunt, F.R.S.; H. Burgoyne; L. Twining (with enclosure); A. S. Herschel; J. Ingram (with enclosure); J. Layton (with enclosure); C. Greville Williams, F.R.S.; Henry Woodward; F. Bright; C. R. C. Tichborne; J. N. Vinen; the Metropolitan Association of Medical Officers of Health; S. W. Moore; T. Landaner (with enclosure); George Lunge; C. Foster, B.A.; Ludwig Mond; W. M. Watts, B. Sc.; Dr. F. C. Calvert, F.R.S.; C. R. C. Tichborne; Gossage and Son (with enclosure); Jesse Fisher, do.; Benjamin Wheeler, do.; G. Eccles, do.; Smith and Sons, do.; J. Sampson, do.; J. Thom, do.; W. Blyth, do.; W. M'Leod, do.; H. Eve; C. R. A. Wright, B.Sc.; W. Kunde; F. Hughes; R. C. C. Lippincott; D. Waldie (Calcutta); J. D. Dana; Professor How, D.C.L.; Dr. August Stromeyer; F. O. Ward; Captain R. F. Burton (with enclosure); A. P. Hurlstone; S. Norman; Dr. P. Williams; B. Quaritch; J. Foord (Victoria); J. Thom (with enclosure); John Lundy.

Books Received: "Crystallogenic and Crystallographic Contributions," by James D. Dana.

*** * The Circulation of "The Chemical News."**—
Certain persons having been industriously spreading the report that the circulation of the CHEMICAL NEWS is only about one-third its real number, the Publisher takes this opportunity to inform advertisers that if they will favour him with a call at the office the books will be freely open to their inspection, and he will undertake to prove to their satisfaction that THE CIRCULATION OF THE CHEMICAL NEWS EXCEEDS 2,000 COPIES WEEKLY.

THE CHEMICAL NEWS.

VOL. XVI., No. 400.

NOTES ON SOME COMPOUNDS OF PALLADIUM.

By HENRY CROFT,
Professor of Chemistry, University, Toronto.

PALLADIO-BICHLORIDE of potassium is best prepared by passing chlorine through a concentrated hot solution of the palladio-protocliloride. Almost the whole of the metal is precipitated as a double salt of a fine colour. What remains in solution may be advantageously employed in preparing the chloride of palladammonium.

The double salt PdCl_2KCl exhibits a remarkable change of colour on the application of a moderate heat, turning quite black, and resuming its scarlet colour on cooling. If heated too strongly it fuses, loses chlorine, and, on cooling, is of a brown colour, being converted into the palladio-protocliloride.

Cyanide of Palladammonium, originally described as ammoniated cyanide, is readily obtained by adding HCy to a solution of NH_3PdCl . It forms a white crystalline powder, soluble in hot water. Analysis showed it to be Fehling's salt.

Sulphide of Palladammonium.—When dilute $\text{H} \left\{ \text{S} \right\}$, or very dilute $\text{NH}_4 \left\{ \text{S} \right\}$ is added to a solution of NH_3PdCl , a bright red, or orange red precipitate is formed, much like the sulphide of antimony; it changes very rapidly into brown or brownish black sulphide of palladium.

Double Sulphocyanides.—These may be obtained in precisely the same manner as the platinum compounds described by Buckton. The potassium salt forms ruby-red crystals, which can be obtained of considerable size, soluble in water and alcohol. The latter solvent was used for separating it from the chloride. The salt is anhydrous, melts at a high temperature, gives off sulphur and bisulphide of carbon, and is oxidised by nitric acid, forming a white compound free from sulphur, apparently analogous to Claus's product. The solution of the potassium salt precipitates various metallic solutions, forming apparently corresponding insoluble palladio-sulphocyanides.

Similar compounds can be obtained from the palladio-protocliloride. The potassium compound forms dark red needles. From the few analyses I was able to make, the composition of all the above salts seems to be the same as that of the platinum compounds.

By acting on the potassium salts with ammonia, a salt is obtained crystallising in fine reddish brown needles; the same can be obtained by acting on chloride of palladammonium with sulphocyanide of potassium in the same way as recommended by Buckton for the platinum salt.

The analysis gave the formula $\text{NH}_3\text{Pd} \left\{ \text{S} \right\}$ -sulphocyanide of palladammonium.

The sulphur is oxidised with great difficulty, even by hydrochloric acid and potassic chlorate.

Several compounds of palladammonium with organic acids, especially nitro-acids, are well crystallised, more particularly the trinitro-phenylate or carbazotate.

Petroleum as Fuel.—According to Adam's trials with petroleum for heating boilers, the following advantages, in comparison to coal, resulted:—Quicker steam generation, smaller dimensions of fire-place and boiler, constant firing, no smoke, ashes, or residua (these amount from 7 to 16 per cent when using coal); possibility of having an intense fire at once without the assistance of increased draught (this is of great importance to steam vessels); easier working, and considerably smaller store-rooms than coal would require.—*Revue Univers*, X. ann., livr., p. 206, with drawing.

ON THE MANUFACTURE OF NICKEL.

By DR. AUGUST STROMEYER.

THE following communication concerning the production of nickel, will, no doubt, interest some of your readers. The method employed was kept a secret for a long time, and is partly so even now.

Formerly, nickel was produced from the speiss obtained in the making of smalt, but since the perfection attained in the manufacture of artificial ultramarine, smalt has not been so much in demand; less has therefore been made, and the old stores of speiss have been used up.

Recently some speiss has been produced from copper and silver ores containing nickel. These ores are smelted with pyrites, by which means the copper and silver are concentrated in the sulphide of iron. If the ore contains nickel in combination with arsenic (if not, arsenical pyrites is added), a bright heavy regulus composed of arsenic, nickel and cobalt, called speiss, will be found beneath the slag.

By an oxidising smelting, the speiss becomes purified, so that only arsenical nickel remains.

The speiss, in a pure state, has the composition Ni_3As (52 per cent of nickel); ordinarily, it contains iron, cobalt, bismuth, lead, antimony, and sulphur.

By smelting the speiss, or any nickel ore in contact with atmospheric air, and a reagent capable of fluxing the resulting oxide, pure arsenical nickel (Ni_4As) is obtained. The remaining separation of arsenic from the nickel is very difficult.

The following process for the production of nickel is that used at Dittenburg (Nassau). The ore is iron pyrites containing capillary pyrites (NiS), and occurs in veins of serpentine. Besides the nickel ore, a copper ore is also worked. The nickel ores are not previously prepared, as the matrix gives a suitable slag.

The average composition of these ores is:—

Dolomite	.. ..	\text{CaO, CO_2	.. ..	8.07
	.. ..	\text{MgO, CO_2	.. ..	8.13
Sparry iron ore	.. ..	\text{FeO, CO_2	.. ..	22.86
Copper pyrites	.. ..	$\text{Cu}_2\text{S} + \text{Fe}_2\text{S}_3$	.. ..	21.98
Nickeliferous pyrites	.. ..	$\left\{ \begin{smallmatrix} \frac{2}{3}\text{Ni} \\ \frac{1}{3}\text{Fe} \end{smallmatrix} \right\} \text{S}$	.. ..	6.88
Bismuth glance	.. ..	\text{BiS_2	.. ..	2.05
Iron pyrites	.. ..	\text{FeS_2	.. ..	7.72
Red hæmatite	.. ..	\text{Fe_2O_3	.. ..	11.61
Quartz	.. ..	\text{SiO_2	.. ..	10.33
Moisture	.. ..	.. ..	.. ..	0.27
As, Co, KO, NaO	.. ..	.. ..	.. ..	0.30

100.20

Other analyses make the nickel to exist as capillary pyrites (NiS)—this mineral is seen now and then in the ores. The ore yields on an average 3 per cent of nickel and 5 per cent of copper. In 1857, Heusler introduced a process for the production of a nickel-copper alloy similar to the Swedish one.

The process may be divided into four parts.

1. Raw Melting.—Roasting the ore and smelting it to coarse metal.

2. Concentration Melting.—Roasting the coarse metal and smelting it to a concentrated regulus.

3. Refining Melting.—Separation of the iron from the concentrated regulus.

4. Roasting and Reducing Process.—Transformation of the regulus into oxides of copper and nickel by roasting, and reduction of the oxides to copper-nickel.

1. Raw Melting.—The ore is crushed to pieces of the size of a man's fist and roasted in kilns. On the sole of the furnace are bedded about $\frac{1}{8}$ cwt. of charcoal, then $\frac{1}{4}$ cwt. of brown coal, then 15 cwt. of ore, then again $\frac{1}{4}$ cwt. of brown coal, and finally 25 cwt. of ore. The charcoal at the bottom is lighted, and, after 12 hours, the roasting will have proceeded so far that three-fourths of

the ore may be taken out of the furnace as being well roasted. Brown coal and ore are again put on in layers. 100 cwt. of roasted ore is mixed with 63 cwt. of slag from the former melting, and smelted with coke in a furnace. This is filled with charcoal, which is lit and allowed to burn down a little, which having taken place, one barrow of coke and two of slag are put on, and the blast-engine worked. Two barrows of mixture are now put on to one of coke, and, by a gradually increasing amount, seven or eight barrows of mixture are added within a few days to one of coke. (One barrow of coke = 20 lbs.; of mixture = 30 lbs.) The silicious slags from the copper-ore smelting are the most convenient to employ. One operation usually lasts six weeks.

2. Concentration Melting.—The regulus is now stamped and passed through sieves. It is then roasted in a reverberatory furnace. The charge of the furnace is 10 cwt., the volume of which becomes doubled by roasting.

The firing in the beginning of the process is kept low, as the heat increases by the oxidation of the charge. After two hours the heat is raised, till at the end of the process it reaches a white heat. During the last two hours powdered charcoal is added to decompose any sulphates formed.

Sohnabel has made most careful analyses of the regulus removed at different times during the process. From these it is found that the desulphurisation takes place gradually.

The regulus still contains 7 per cent sulphur. It is again smelted, being now mixed with 1 per cent of lime. 100 cwt. is prepared with 67 cwt. of silicious copper cinders, poor in oxide. The charge commences with 2 barrows of preparation to 1 barrow of coke, and the proportion increases to 5 or 6 barrows in 24 hours.

3. Refining Melting.—This melting operates as an oxidation process, and is used to separate completely the iron. It is carried on in a copper refining furnace with silica. Here the concentrated regulus is smelted with coke, when it melts and falls in drops to the bottom of the furnace. The iron remains in the slag as silicate of protoxide of iron, which is easily fusible.

To melt 170 lbs. of regulus it takes about 1½ hours. The fuel is now taken out of the furnace, and the slag on the surface of the metal, cooled by a blast and renewed. The process is renewed with fresh flux, and repeated until the slag possesses an enamel-like appearance, a proof of the separation of the iron. The resulting metal is melted and drawn off by a gutter in the smelting hearth.

4. Roasting and Reducing Process.—The nickel-copper regulus thus obtained is now converted by roasting into oxides of nickel and copper. For this purpose it is ground to powder and sifted through very fine sieves; 4 cwt. of the powder are spread out on the hearth of a reverberatory furnace, and are roasted for 12 hours, being continually and thoroughly stirred up. The regulus by this roasting becomes desulphurised till it contains not more than ¾ per cent. The powder is then again roasted for 8 hours, at first at a red heat, and finally at a white heat. By this treatment all the sulphur, and also the small amounts of antimony and arsenic still retained, are separated.

The manipulation used in this latter process is kept a secret. The writer presumes that the regulus is mixed with carbonate and nitrate of potash; by heating with this mixture sulphantimoniate and arseniate of potash would be formed,—compounds soluble in water. The oxides of copper and nickel have now only to be reduced to the metallic state. The moistened oxide, in charges of 150 or 200 lbs., is reduced in a charcoal furnace.

The slags contain nickel and copper, partly scorified, partly mechanically suspended. They are reserved for re-smelting.

The result of the process just described is an alloy of copper and nickel; the nickel is therefore in a convenient form for use in the manufacture of German silver.

ON THE INACTIVE CONDITION OF SOLID MATTER.

In the *CHEMICAL NEWS* for Nov. 30, 1866, we gave an account of some remarkable experiments by M. Gernez, as recorded in the *Comptes Rendus* for 19th November, 1866. It is well known that when a solid body, such as a glass rod, is introduced into soda water, seltzer water, or other supersaturated solutions of a gas, it becomes immediately covered with gas bubbles, and even effervescence may set in. The rod, however, becomes inactive after a short time, or it may be made so by previously immersing it in water, or by heating it in the flame of a spirit lamp, or by keeping it out of contact with air. The theory is that it is not the solid that disengages the gas from its solution, but the air in contact with such solid. The inactive solids become active if exposed to the air for a quarter-of-an-hour or an hour. Every solid, however smooth, is covered with roughnesses that form a sort of network of capillary conduits, into which surrounding gases penetrate and condense; and the gas bubbles thus imprisoned act as centres of force in liberating gas from solution. The rougher the body the more brisk the effervescence. The disengagement of gas ceases in time, since each bubble carries with it a portion of the gas which produced its liberation. Heat expels the gas from the surface of the solid by expansion, and immersion in water by solution.

In order to support this view, the author relies upon the following experiment:—"I introduced into a supersaturated aqueous solution of carbonic acid an almost capillary tube, closed at one end and inverted like a gas-jar, and containing air. I had previously deprived this tube of the property of liberating gas. Immediately after immersion, gas adhered to the column of air which the tube contained, forming quickly a large bubble, which was disengaged; then another was produced, and so on. The gas formed then only at the point where the liquid touched the column of air. From this experiment, which I have varied in several ways, it may be concluded that air liberates carbonic acid from its aqueous solution." It is further stated that the nature of the gas is of no consequence, for "supersaturated solutions lose their gas under the influence of any gas bubbles whatever."

In the August number of the *Philosophical Magazine* Mr. Tomlinson, F.R.S., of King's College, combats the above theory, and denies that air or gas has any action in liberating gases from their solutions. The theory that he proposes to substitute rests on the distinction between a chemically clean solid and one that is clean in the ordinary sense of the word. If the solid be chemically clean there is perfect adhesion between it and the solution, and there is no liberation of gas; if the solid be not chemically clean, then the adhesion is imperfect, and there is a separation of gas. If the water is not attracted by the solid, the gas is; for although the rod may not be clean enough for water to adhere to it, yet gas will adhere to a dirty or a greasy rod. If the rod be made chemically clean it soon ceases to be so by exposure to the air; and this circumstance, according to Mr. Tomlinson, has led the numerous writers on supersaturated solutions of salts into error as to the action of *nuclei*, &c., in inducing crystallisation. If the nucleus be chemically clean, the solution wets it perfectly, and there is no separation of salt from the water; if the nucleus be not chemically clean the adhesion is differently distributed between the water and the salt, or the water and the gas, and there is a separation. According to this view a chemically clean body which appears to be "inactive," is really most active; while the so called "active" condition is really one of imperfect adhesion.

We select a few of Mr. Tomlinson's experiments in support of this novel view, which, if admitted, will throw a great deal of light on a very obscure object:—

Experiment 1. Two ordinarily clean test-glasses, A and B, were taken; A was first filled with methylated spirits

of wine and then rinsed with abundance of water. A bottle of soda water was now poured gently into the two glasses. The inner surface of B was profusely covered with gas bubbles, but not a single bubble was seen on the surface of A.

Experiment 2. A glass rod and a platinum spatula were dipped into A and B, and produced abundant effervescence. They were dipped into spirits of wine, rinsed, and again put into A and B. Not a bubble of gas appeared on either surface, except above the points at which the bodies had been made chemically clean, and there numerous gas bubbles appeared. Indeed it was accurately determined by the formation of these bubbles how far the solids had been dipped into the spirit.

Experiment 3. A rat's-tail file made chemically clean did not liberate any gas; but dried and drawn through the moist hand (experiment 4) it liberated gas abundantly.

In like manner dry iron filings (experiment 5) that produced effervescence, did not do so after being washed in spirit; when thrown wet into soda water the spirit was of course displaced by the liquid, and the filings were wetted by it, and yet there was no liberation of gas.

A wire gauze cage (experiment 7) full of air was lowered into soda water and there was no escape of gas so long as the cage was chemically clean; when the cage was handled with dirty hands (experiment 8) and put into the soda water there was an abundant effervescence.

Experiment 9. A glass rod was heated in oil above 300° F; then wiped with a duster and put into soda water. It was instantly and completely covered with gas bubbles.

Experiment 11. A large fragment of flint was broken into two pieces and put into soda water. Gas was abundantly liberated except from the two new and chemically clean surfaces, and on them not a bubble was seen.

Experiment 12. A narrow tube eleven inches long was kept in spirits of wine for an hour for five inches of its length. It was closed at top and so lowered into soda water. There was no liberation of gas either from the tube or the column of air in contact with the solution. On removing the finger, the solution ascended the tube, but there was no liberation of gas until the solution touched that part of the tube which had not been immersed in the spirit, and from this gas was liberated both from the outside and inside of the tube. It is remarked that had M. Gernez made the inside of his tube as "inactive" as he made the outside, he would have seen that the column of air had really no action in liberating the gas.

ON THE UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 46).

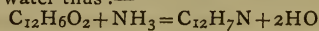
Looking, therefore, at the compositions of the principal products of coal tar distillation, it may be said that the *crude naphtha* contains certain alliaceous oils, with benzole, toluole, xylene, cumole, and a little cymole, besides the more volatile basic compounds, as pyridine, picoline, lutidine, collidine, and a little aniline, with from 2 to 3 per cent. of carbolic acid and a little naphthaline.

Light oil contains cumole, cymole, and the other less volatile hydrocarbons, with a large amount of naphthaline, and the denser alkaloids, as collidine, aniline, toluidine, and even a little chinoline; besides which it contains from 10 to 20 per cent. of carbolic and cresylic acids.

Heavy oil consists chiefly of hydrocarbons which have not been well studied, and the bases which have a high boiling point, as chinoline, lepidine, and cryptidine, with small quantities of cumidine and cymidine, and from 7 to 10 per cent. of carbolic and cresylic acids.

Carbolic acid ($C_{12}H_6O_2$), or as it is sometimes called *phenic acid*, is largely in demand for making dyes and

for disinfecting purposes, and it is most profitably extracted from the light oil before it is distilled for benzole, &c. The naphtha which flows over between 300° and 400° Fahr., and which has a gravity below 900, is best suited for the preparation of carbolic acid; for although there is much acid in the heavier oils, yet they are so nearly of the same gravity as the alkaline solution used in extracting it that there is great difficulty in separating them. The light oil is well shaken with about one-third of its bulk of a solution of caustic soda of from 14° to 16° Twaddle (1.07 to 1.08 sp. gr.) and containing from 5 to 7 per cent. of alkali. After standing for some time the oil separates, and the alkaline liquor may be drawn off by means of a syphon. This is to be neutralized with sulphuric or muriatic acid, and then the carbolic acid floats as a dark brown oil. This is the crude acid of commerce, and when purified by means of sulphuric acid and careful distillation from chloride of calcium, it forms the camphor-like substance which you here see. It has a peculiar creosote-like smell, and when largely diluted with water, even to the extent of 1 part in 10,000, it has a sweet taste. It is a very powerful caustic, turning the skin white and quickly raising a painless blister. The specific gravity of the pure acid is 1.065. It melts at from 95° to 98° Fahr., but the merest trace of water will lower its melting or congealing point, so that this is the test of the quality of the acid. It boils at 366° or 370° Fahr., and its vapour burns with a sooty flame. If it be passed through a red-hot tube it is decomposed, forming naphthaline and other hydrocarbons; and if it be heated for some time with ammonia in a closed tube, at a temperature of from 400° to 500° Fahr., it produces aniline and water thus:—



Carbolic acid.

Aniline.

It combines with alkalis to form salts, but the combination is very feeble, for the acid is set free by heat and even by the carbonic acid of the atmosphere, so that the common preparation of it, carbolate of lime, slowly evolves carbolic acid when it is exposed to the air.

The acid is a very powerful antiseptic and disinfectant. It is especially destructive of the lower forms of organic life, and hence, perhaps, its value as a disinfectant. Several varieties of the acid are now prepared and sold for general and medical purposes, and the experience of the last few years has proved it to be an important hygienic agent. Its use in the preparation of dyes will be explained directly.

The other acids of coal tar, as *cresylic* ($C_{14}H_8O_2$), *phlorylic* ($C_{16}H_{10}O_2$), *rosolic* ($C_{24}H_{12}O_6$), may be obtained by the use of a stronger alkaline solution as recommended by Laurent. A saturated solution of potash, added to the mixed light oil and heavy naphtha, and then treated with a little powdered caustic potash, will produce a magma from which the unattacked liquid oil may be separated. By dissolving it in a small quantity of water and allowing it to stand, it separates into two layers—an upper oily layer which is of no use, and a lower layer which contains the tar acids. When this is neutralized with muriatic acid, the crude acids float as an oily layer, and may be separated from each other by fractional distillation.

IV.—SPENT OXIDE OF IRON.

This is the next substance in order of the purification of coal gas. In its fresh state the hydrated peroxide of iron freely absorbs the sulphuretted hydrogen of foul gas, forming the black sulphide of iron. On exposure to the air the iron again absorbs oxygen, and becomes revived—the sulphur which it had before taken in as sulphuretted hydrogen being set free among the particles of the oxide. In this manner, by a succession of foulings and revivifications, the oxide becomes so charged with sulphur as to be unfit for use. It then contains from 35 to 57 per cent of sulphur, the average being about 42 per cent; and

although it is useless at the gas-works, it is of some value in the production of oil of vitriol. Special furnaces, however, are necessary for its combustion, for as it contains about 20 per cent of sawdust it is not capable of being used in ordinary sulphur furnaces. At Messrs. Lawes and Messrs. Hills, where I have seen the spent oxide largely used for making sulphuric acid, the furnaces are constructed with very long flues, for the purpose of completely burning the organic vapour before it enters the vitriol chamber. Each furnace is about 12 feet long and 18 inches square, with a floor of fire-brick, upon which the oxide burns. It takes about $2\frac{1}{2}$ cwts. of oxide at a charge, and it burns continuously for twelve hours. The air is admitted by a sliding door in front, and the gaseous products are conveyed from the furnaces, which are placed side by side, and in three tiers over each other, to a common flue at the back, and this is extended backwards and forwards, below and above, so as to prolong the combustion to the greatest extent before the vapours enter the vitriol chamber, for if the combustion is not complete there is a considerable waste of nitre; as it is, indeed, the quantity of nitre used for the oxidation of the sulphurous acid is always about half as much more as is required with native sulphur or pyrites. I think the process might be very considerably improved by continuous instead of intermittent burning, and there is no reason why the use of sawdust may not be abandoned altogether, and spent oxide employed in its place.

V.—SPENT OR REFUSE LIME.

This is generally a very profitless material—in fact, the blue billy from the wet-lime purifiers is incapable of any sort of application but that of luting. Dry lime, however, is not so unmanageable a product, for if it is treated properly it need not occasion offence; and when it is well weathered it is of some value to the farmer. Professor Voelcker has inquired very fully into this matter, and he states that it is useful to certain soil on the following account:—

1. It improves the texture of stiff clay soils by lightening them, and of light sandy soils by giving them solidity.
2. It neutralizes the acidity of some soils, and breaks up the organic matter of soils which are too rich in humus, making them more fit for the sustenance of plants.
3. It acts on the granitic constituents of a soil, and sets free the alkalies, thereby making the mineral elements of it available as food for the plant.
4. It supplies food to the plant in the form of sulphate of lime, which is especially useful to the leguminosæ.

And he concludes that well weathered gas lime, judiciously applied to a proper soil, is most useful to many plants, as clover, sainfoin, lucerne, peas, beans, vetches, and turnips; and that it is a good fertilizer, for permanent pasture, especially if the land is deficient of lime. On natural grasses the best farmyard manure often produces but little improvement until a dressing of lime, marl, or gas lime has been applied to it: the latter, more particularly, destroys the coarser grasses, and favours the growth of a sweeter and more nutritious herbage. It also destroys moss, heath, feather-grass, and other plants which are characteristic of peaty land. It is therefore, especially suited for the improvement of such land; and so it is for the land which is deficient of lime, and which causes turnips to become warty, and be affected with the disease called "fingers and toes." For this it has been found a complete remedy. It may be applied in quantities of from one to two tons an acre, and even more where lands are very heavy, or are very peaty; and the best time to apply it is in the autumn, when vegetation is dormant, so that it can not only weather before the spring returns, but also act on the land during the whole of the winter.

One special precaution is that the lime should never be used in its fresh state, when it contains sulphide and sulphite of calcium in such proportions as to be injurious to plants. The more it is oxidized the better, and, therefore, when it is drawn from the purifiers it should be covered over with old material, so as to prevent smell, and kept until it has lost its activity. The fresh lime contains from 15 to 25 per cent of quicklime, with a large proportion of sulphide, carbonate, and sulphocyanide of calcium; and even after six or eight months it may still contain a notable proportion of quicklime, with from 20 to 30 per cent of sulphate of lime, a like proportion of sulphite of calcium, and still more of carbonate, in which condition it is not injurious to plants.

In many places farmers are glad to have the material, and will give as much as 2s. a load for it, although the common price is about 1s. a load.

VI.—ACID AND OTHER ABSORBENTS OF AMMONIA.

At the end of all the purifiers there may be placed the material which has been patented by Messrs. Sugden and Maryatt. It is made by moistening sawdust with sulphuric acid slightly diluted with water, and heating it in a retort. The woody matter is in this way charred by the acid, and contains from 30 to 45 per cent of free sulphuric acid. When it is exhausted by being charged with ammonia, it contains 40 to 60 per cent of salt, which is easily washed out of it, leaving the charred sawdust ready for another charge of acid. The material, with the sulphate of ammonia in it, is fit for conversion into manure, and is worth £5 or £6 per ton. Another absorbent of a like nature is that used by Mr. Croll. It is made from the spent chloride of manganese from the bleaching-works by adding it to chalk and sawdust, and, when saturated with ammonia, it contains from 39 to 40 per cent of muriate of ammonia, which is easily obtained from it either by washing or subliming.

These are several waste products of the manufacture of gas, and it will be seen that, in the aggregate, their value is not inconsiderable provided they are utilized to the fullest extent.

(To be continued.)

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

YOUR correspondent is so profoundly impressed with the vulgarity of enthusiasm, that he has endeavoured to the very utmost to suppress any traces of that objectionable sentiment in his letters. In fact, it is very difficult to be guilty of the fault alluded to after spending a week in the Exposition. Gazing at works of science or art for a long time, especially if one is to write about them, produces a state of mind in which an almost stupid tranquillity is a prominent feature, and your correspondent verily believes that the "dignified repose" which the world admires in some of its idols, is often so nearly allied to stupid tranquillity, and is so difficult to distinguish from it, that it may be said to be merely an isomeric modification. The poor worn-out Frenchman who complained so bitterly that he had had "beaucoup de Sultan," told me in confidence that the air of dignified repose which so eminently distinguishes Abdul Aziz when inspecting the greatest triumphs of science, was in fact the stupid tranquillity of ignorance. He also informed me that the predecessor of Abdul-Aziz (Abdul-as-was?) generally enjoyed the same enviable state of mind. Certain it is, that the only thing in the building which caused a smile of intelligence to pass over the Sultan's face, was a punching machine in full work, and when he was told by his interpreter that it was capable of administering 1,000 punches a minute, he replied with decided animation, that he would take one home for the benefit of the heads of those who had persuaded him to

leave Turkey. Let us hope that the fatigues to which you will subject that unhappy potentate in England, will make him forget his severe (although just) determination. To return to our work:—

Your correspondent examined with great interest the two cases of Messrs. Calvert and Lowe. They are described in the English catalogue as follows:—

14. Calvert, F. Crace and Co., Gibbons Street, Bradford, near Manchester. Carbohc acid, &c. 60. Lowe, Charles and Co., 14, Fountain Street, Manchester. Carbohc acid and its derivatives, &c.

The chemist who would follow the history of carbohc acid would have to pass in review one of the most interesting phases in the whole of organic chemistry. Discovered in 1834 by Runge, it forms one of the vast number of intensely interesting substances presented by that remarkable man to science as mines of wealth to be explored step by step, and more and more minutely, as methods of investigation were perfected. It is, in fact, one of those products of destructive distillation, whose history, which reads like a romance, has been developed by the labours of nearly all the greatest names associated with organic chemistry—Runge, Laurent, Gerhardt, Wöhler, Kopp, Hofmann, Williamson, Kolbe, Cahours, Erdmann, Fritzsche, Piria, Liebig, Dumas—all these names are found at the head of the memoirs in which are developed step by step the history of carbohc acid.

Carbohc acid, known also as phenol, phenic acid, hydrate of phenyl, phenylic alcohol, and coal tar creosote, has the formula C_6H_6O , and may be represented as water in which one atom of hydrogen is replaced by the radical phenyl. It is produced in a state of considerable purity by distilling salicylic acid; the carbohc acid from this source has, however, been asserted, too hastily, to be only isomeric with the coal-tar substance.

The fact is, that until very lately, chemists had no opportunity of working with carbohc acid of perfect purity. This has led to many incorrect ideas regarding it; for example, one of the differences between the carbohc acid from coal tar and that from salicylic acid, has been said to be the greater rapidity with which the crystals from the former source liquefy when exposed to the air, but, when perfectly pure, crystals of the coal-tar acid may be exposed without deliquescing for months together.

It is remarkable, moreover, to find that the substance whose properties we are discussing, is one of those which, as far as purification goes, has been grappled with more successfully in the manufactory than in the laboratory. The most severe test for the purity of carbohc acid, like that of most crystalline organic substances, is its melting point. According to Gerhardt this is between 34° and 35° (*Chimie Organique*, iii. 16.) But crystalline carbohc acid can now be obtained in commerce, of which the melting point is as high as 42° , or even a little higher. On the other hand, the boiling point of this pure acid is given by Mr. Lowe as 182° thermometer, in liquid, or $178^\circ.8$ thermometer in the vapour, the atmospheric pressure being 743.19 mm. (29.26 inches), whereas Laurent gives 187° — 188° , and Scrugham, who worked on the subject in the laboratory, and under the eye of Williamson, gives 184° . From this we conclude that pure carbohc acid has a much higher melting point, and a somewhat lower boiling point than has been ascribed to it hitherto.

Messrs. C. Lowe and Co. exhibit a large mass of absolutely pure carbohc acid, weighing no less than two cwt., having the melting and boiling points given above. It is proper to mention that Dr. Crace Calvert, who is fully cognisant of all the facts recently discovered relating to carbohc acid and its congeners, gives 187° as the boiling point of carbohc acid* agreeing nearly with the determination of Laurent.

The firm of F. C. Calvert and Co. were the first to manufacture carbohc acid in a comparatively pure condition; it then consisted in a colourless fluid yielding crys-

tals at 15° . This was in 1859. In 1861 they succeeded in obtaining it in colourless detached crystals, fusing at about 25° . Two years later the manufacture was so far improved that the melting point of their best acid was raised to 34° , the number given by Gerhardt. At the end of 1864 they succeeded in removing the sulphur compounds which adhere with such tenacity to the acid products of coal tar, and thus rendered the carbohc acid fit for medicinal purposes. It was not until 1866, however, that the absolutely pure acid was isolated with a melting point between 41° and 42° . Other manufacturers do not appear to be aware of the processes employed by Messrs. Calvert and Lowe, for they do not exhibit in their cases acid of a higher melting point than about 25° .

Messrs. Lowe and Co. state that absolutely pure carbohc acid *does* slowly become coloured by exposure to light, and that when this coloration is not observed, it arises from the protective influence of certain impurities, apparently sulphur compounds.

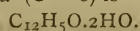
Messrs. Calvert and Co. also exhibit their disinfecting powder, salve for foot rot in sheep, and sheep dip, also picric acid and aurine, and, finally, rosolic acid.

Messrs. Lowe also exhibit picric acid, prepared by the action of nitric acid on sulpho-phenic acid, a process which is said to have several advantages, particularly as regards the quantity of the resulting product. They also show rosolic acid and a fine lake prepared from it for the use of paper-stainers. In addition to the above they have in their case picramic acid prepared by reducing picric acid with an alkaline sulphide. It is used in commerce for dyeing browns.

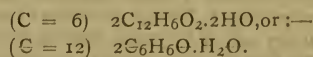
Messrs. Lowe's case contains a series of specimens which almost exactly represent the various epochs of the improvements in the manufacture of carbohc acid, alluded to above. They consist of the various commercial qualities, having the following melting points:—

Crude carbohc acid, fluid at ordinary temperatures.			
Purified	do.	melting at	15°
"	"	"	29
"	"	"	35
Pure	"	"	42.25°

They also exhibit what they and Dr. Calvert insist on calling bi-hydrate of phenyl. This substance is simply carbohc acid, with water of crystallisation. Dr. Calvert's formula ($C = 6$) is



But as the water of crystallisation is given off on the application of heat, it is obvious that the true formula is:—



It gives your correspondent much pleasure to admit the gratification he derived from the examination of the cases of Messrs. Calvert and Co., and Messrs. C. Lowe and Co. Messrs. Calvert and Co's., case would, however, have appeared to much greater advantage if the globes containing the specimens had not been covered to such an extent by loose paper advertisements, which to a great extent hide the contents.

Messrs. Calvert and Co. have obtained a silver, and Messrs. Lowe and Co. a bronze medal.

Fusibility of Aluminates containing a large amount of Lime.—(Freym.) Mixtures of 80 parts lime and 20 alumina and 90 parts lime and 10 alumina become completely liquified when heated in crucibles in a wind furnace. Mixtures of 93 lime and 3 alumina still frit at such temperature. The cooled masses have crystalline fracture, alkaline reaction, swell up in water, and may be used in metallurgy on account of their affinity for sulphuric and phosphoric acid.—(*Dingl. F. bd. 177, p. 376.*)

* *Chem. Soc. J.*, xviii. 66.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, JULY 30, 1867.

Discovery of the Cromlech of El-lanic.—Ancient pottery, worked flints, and stone hatchets.

At the last meeting of the Polymatic Society of Morbihan, M. de Closmadeuc gave a description of a very fine cromlech discovered by him in a very small desert island in the gulf of Morbihan, called El-lanic, situated south of Gavara's. This cromlech is represented by more than sixty obelisks of granite forming a vast regular circle of 180 mètres in circumference. The mean length of the blocks is three mètres. One of the blocks is of colossal size; it is broken into two fragments, and measures 5'30 mètres long by two mètres thick. A curious fact worthy of notice is that one half of the cromlech is no longer on the island but on the sea shore, so that the view of the whole circle is only attainable at low water; the sea has encroached by degrees on the island on the south side where the cromlech is found, and eaten away half the ground.

M. de Closmadeuc, who has made excavations in the neighbourhood, has discovered an incredible mass of ruins and antiquities, the nature of which cannot be doubted:—1. An enormous quantity of pottery perfectly similar to those habitually found in Celtic monuments. 2. A quantity not less considerable (several hundreds) of flints worked by man, analogous to those found in ossiferous caverns, or of Grand-Pressigny. 3. A great number of stone hatchets which have been found under the Armorican Dolmens.

The discovery of the cromlech of El-lanic is of great interest. It is most remarkable and the most complete of the cromlechs hitherto known in the Morbihan.

ACADEMY OF SCIENCES.

JULY 22, 1867.

(FROM OUR OWN CORRESPONDENT.)

Sir D. Brewster on liquid films and figures of equilibrium.—Storms exceptionally caused.—Proportion of iodine in mineral waters.—Classification of meteorites.—Discovery of universal gravitation, letters of Pascal to Boyle; Discussion; Newton and Pascal in correspondence.

Sir David Brewster addressed copies of his pamphlets (reprinted from the Royal Society of Edinburgh) on the colours of thin liquid films and their figures of equilibrium, of which we have already published the analysis. The illustrious professor, foreign associate of our academy of sciences, at the age of 85 years, retains his memory so fresh and bright that the two memoirs in question seem to be the offspring of a youthful mind.

M. Fournet de Lyons addressed a note on the exceptional storms caused by the south-west winds.

We understood, vaguely, that there were communications on geological sections of the Alençon railway—of a memoir by M. Thibaut on inundations—of an efficacious method of treating croup, by Dr. Abiëlle—of researches on electricity by M. Girard—of a means of ascertaining the proportion of iodine contained in mineral waters and in alkaline salts—of a memoir by M. Humbert on the resistance of a voltaic pile, &c.

M. Daubree read the second part of his memoirs on the classification adopted for the collection of meteorites in the Museum of Natural History. His principal divisions of solid and coherent meteorites are as follows:—1st Class: *Siderites*—meteors containing iron in a metallic state; sub-division, containing stony substances. 1. *Holositides*—Meteorite iron properly so called; second sub-division containing iron and stony substances. 2nd Group: *Syssiderites*—iron in the form of a continuous mass. 3rd Group: *Sporadosiderites*—iron in the form of disseminated

grains; 1. Sub-group of sporadosiderites. *Polysiderites*, when the quantity is considerable. 2. Sub-group: *Oligosiderites*, containing a small quantity of iron. 3. Sub-group: *Cryptosiderites* in which the iron is invisible to the eye. 3rd Class: *Asiderites*. 4th Class: *Asiderates*.

M. Le Verrier called upon M. Chasles relative to the letters and notes of Pascal printed in the Comptes rendus, and of which we give, before resuming this long discussion, a few important passages:—8th May, 1652, Pascal to Boyle—"J'ay pour le prouver un bon nombre d'observations de toutes sortes dont personne m'a encore parlé, et partant en connaissance, tant sur l'attraction et de ses lois avec les phénomènes. Je viens vous en faire part. Vous trouverez ci-joint les expériences, au nombre de plus de cinquante. . . . "PASCAL."

2 Sept., 1654 or 1655.—Again to Boyle.—"Dans les mouvements celestes, la force agissant en raison directe des masses et en raison inverse du carré de la distance suffit à tout, et fournit des raisons pour expliquer toutes les grandes revolutions qui animent l'univers. Rien n'est si bon selon moy; mais quand il s'agit des phénomènes sublunaires, de ces effets que nous voyons de plus près et dont l'examen nous est plus facile, la vertu attractive est un Protée qui change souvent de forme. Les rochers et les montagnes ne donnent aucun signe sensible d'attraction. C'est, dit-on, que ces petites attractions particulières sont comme absorbées par celles du globe terrestre, qui est infiniment plus grands. "PASCAL."

Note to Boyle.—"Le corps en vertu de la tendance au mouvement que l'attraction lui imprime est capable de parcourir un espace donné dans un temps donné. La vitesse initiale sera donc proportionnelle à l'intensité de l'effort ou de la tendance imprimée par la puissance attractive; et cette intensité sera elle-même proportionnelle à la masse attirante à égale distance, et (à) différentes distances, comme la masse attirante divisée par les carrés de ces distances.

"Les observations astronomiques apprennent que toutes les planètes se mouvent dans une courbe autour du Soleil, et qu'elles sont accélérées dans leur mouvement à mesure qu'elles approchent de ce globe, et qu'elles sont retardées à proportion qu'elles s'en éloignent, tellement qu'un rayon tiré de ces planètes au Soleil décrit des aires ou des espaces égaux en temps égaux. "PASCAL."

"J'ai dit que la force de projection qu'on nomme force centrifuge varie continuellement, parce que l'attraction est plus ou moins grande suivant que les planètes s'approchent ou s'éloignent du soleil. Pour concevoir comment cette révolution s'opère, supposons qu'une planète soit à la partie de son orbite (ou de l'ellipse qu'elle parcourt) la plus proche du soleil, la force attractive est dans cet état plus grande que dans toute autre situation, à proportion que le carré de la distance est moindre. Elle devrait donc faire tomber la planète sur le soleil, mais la force centrifuge produite par le mouvement circulaire autour du soleil augmente en plus grande proportion. "PASCAL."

"La puissance qui agit sur une planète plus proche du soleil est ordinairement plus grande que celle qui agit sur une planète plus éloignée, tant parce qu'elle se meut avec plus de vitesse qu'à cause que son orbite est moindre et qu'elle à plus de courbure. En comparant les mouvements des planètes, on trouve que la vitesse d'une planète plus proche est plus grande que la vitesse d'une planète plus éloignée, en raison de la racine quarrée du nombre qui exprime la plus grande distance à la racine quarrée de celui qui exprime la moindre distance. "PASCAL."

"On peut conjecturer et même inférer qu'il y a une puissance semblable à la gravité des corps pesants sur la terre, qui s'étend du soleil à toutes les distances et diminue constamment. . . . Le même principe de la gravité doit avoir lieu dans les satellites qui circulent autour de la terre, de Jupiter et de Saturne. . . . Car ils ne pourroient avoir un mouvement aussi régulier qu'ils ont s'ils n'estoient assujettis à l'action de la même puissance, &c. "PASCAL."

The intimate acquaintance of Newton with Pascal is proved by letters written by Newton in most excellent French. Newton was then only eleven years old.

The question that M. Leverrier at last put forth, after endless circumlocution, was this:—Is M. Chasles in possession of letters and notes which demonstrate undoubtedly that Pascal knew, not only the laws, but the demonstration of universal gravitation? M. Chasles hesitated to answer, because he would wait till the termination of the discussion of that which he had already spoken of to the academy; he consented, however, to acknowledge that it results from the authentic autographs in his possession that Pascal had determined centrifugal force in the curvilinear motion of the planet; thus, this determination implies the demonstration of the elliptical nature of the curve described under the influence of attraction.

MM. Duhamel, Elie de Beaumont, Pouillet, Faye, Le verrier and Chasles took part successively in the discussion, but on subjects not bearing directly on the question. M. Duhamel supported the adversaries of Newton; he could never understand how he gave, at so late a period, the mathematical expression of the law of gravitation in inverse proportion of the square of the distance. By replacing the ellipse by its osculating circle, he had early found the geometrical expression of the attraction, but it was necessary to deduce from synthetic considerations the value of the radius of curvature of an ellipse, which he could not do later. This geometric determination is very remarkable, and we shall shortly give further accounts of it.

It was well seen with what care M. Chasles avoided avoided pronouncing the name of Newton in his paper. It is not generally known that when Newton was only fourteen years old, Pascal was in correspondence with Newton, and it was at his advice that Mrs. Newton sent her son to Cambridge. This unexpected announcement is most important, especially when these extraordinary documents prove that Pascal was aware of the laws of universal gravitation. Certainly M. Chasles ought to be left at full leisure to prepare his dissertation, which is waited for impatiently by the scientific world.

M. Chevreuil laid on the table two pamphlets relative to Natural History and the Gobelins; the first is a most complete work describing the physical, chemical, and organic properties and relations of all bodies.

NOTICES OF BOOKS.

Observations upon a New and Simple Process for the Preservation of Meat, Fish, Poultry, and other Varieties of Animal Food. London: Simpkin, Marshall, & Co.

A NEW process for the preservation of meat by means of a solution of bisulphite of calcium, has been lately patented by Messrs. Medlock and Bailey; and the pamphlet we are about to discuss has been written with the object of describing the process and its application. It is somewhat unfortunate that the writer adopts the style usually displayed in the commencement of such descriptive pamphlets. He proves satisfactorily to himself that all the processes hitherto employed for the purpose to which this patent is applied are lamentably defective. It is needless to mention the objections raised in each particular case, and it is much to be regretted that the author does not confine himself to a statement of the undoubted advantages possessed by the special process which he advocates, without drawing invidious comparisons.

The preservative employed by Messrs. Medlock and Bailey is undoubtedly a very powerful one, and although its application to the purpose of preserving food may be new, the antiseptic properties of sulphite of calcium have long been recognized; it is, indeed, one of the chief components of McDougall's powder. In the patent now brought before us however, the more soluble bisulphite

is employed. This compound possesses several advantages over other sulphites, which will strike chemists at once. It is easily obtained free from sulphate, and if any sulphate should be afterwards formed by oxidation no unpleasant taste would be noticed by the consumer; these points have probably operated against the extended use of sulphite of sodium. The low equivalent of calcium is also somewhat in its favour. Messrs. W. Bailey and Sons have engaged to manufacture the bisulphite of calcium, and guarantee to deliver it absolutely pure. With regard to the results that have been obtained, as set forth in the pamphlet, they are remarkably good. The ordinary preservative solution is made as follows:—Dissolve about a pint of common salt in four gallons of clear cold water, to which add half-a-gallon of the bisulphite, and mix well: if the meat, &c., to be treated is required to be preserved for a very long period, a little solution of gelatin or white of egg may be added with advantage. All kinds of meat may be kept perfectly sweet by simply soaking the joints in the above preservative solution for ten minutes, and then hanging them up, wetting them again with the solution once a day.

It is stated that beef, mutton, lobsters, &c., treated by this process, kept good for twelve days with the temperature varying between 80° and 110° F., the original odour and flavour remaining unimpaired at the end of the time. In twenty-six hours portions of the same animal matter, unprepared, were absolutely putrid.

The process seems likely to prove valuable both to the public and the patentees.

CORRESPONDENCE.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

SIR,—In reply to A. D., I cannot admit that "both the induced poles of a body undergoing magnetic induction may be regarded as at the same distance from the inducing pole thereby rendering the attraction nil." The side nearest the inducing pole being attracted, and the side furthest repelled, the attraction will always predominate over the repulsion. This is true for an inch, or a foot, and why not for any distance.

When a small needle, previously magnetised, is gently laid on the surface of water so as to float thereon, it arranges itself in the magnetic meridian, although the distance of one end of it from a magnetic pole may be only a fraction of an inch more than that of the other in a total distance of several thousand miles. Again, we know that if a magnet be placed at some distance either above or below the pan of a balance, it diminishes or increases the weight of any magnetic substance placed in the pan. Also, if a magnetised needle be introduced into the pan of a balance, below which a magnet is placed, the apparent weight of the needle varies according as we arrange it with its poles similar or opposite to those of the magnet placed beneath it. The apparent weight of a magnetic substance may then be altered at pleasure, or even reduced to nothing. Thus, when a small needle is attached to the ground by thread fixed to one, or preferably, to both ends, and a horse-shoe magnet is held above it, the needle may be suspended in the air at a distance of an inch or more from the magnet, its apparent weight being thus practically reduced to nothing.

Is there anything wonderful in a magnet being able to attract substances at a distance equal to its own length? Is it not, on the contrary, a thing of common occurrence? Why then should we consider it impossible for the magnet we inhabit to attract bodies on its own surface?

In "Fownes' Chemistry" (p. 94, 9th ed.) we find the following passage:—"Of late the march of the daily variations of declination has been carefully compared with

the positions of the sun as well as the moon at the corresponding period. This enquiry, suggested by General Sabine, and carried on for a number of years in several localities, has led to the remarkable result that these celestial bodies exert a definite influence upon the magnetic needle, and must therefore be considered as magnets, like the earth itself."

If, then, the moon, as a magnet, is capable of exerting a "definite influence" at a mean distance of 237,000 miles from the earth,—if the sun, as a magnet, can manifest its power at a mean distance of 94½ millions of miles from our globe, we are driven to the conclusion that magnetism is a force which like gravity itself, though of a much more feeble character, is common to all bodies existing in space, and is capable of being exerted at immense distances.

It may be said that if the celestial bodies act as magnets on each other, certain oscillations and other changes in the relative position of the various planets, &c., would be from time to time produced, which could not be explained by the action of gravity alone, in union with the centrifugal force. Such changes, indeed, compared with those produced by gravitation, would be of a minute and trifling character; and the fact, therefore, that they have not hitherto been recognised, is no proof that they do not exist.—I am, &c.

JOHN A. R. NEWLANDS, F.C.S.

THE BRITISH SEAWEED COMPANY.

To the Editor of the Chemical News.

SIR,—There is a slight error in your correspondent's notice of our case in the Paris Exhibition, which please permit me to correct.

"No. 2, from Bardarrig is at present sold for bleaching," this should be *blackening*.

No thorough scientific examination of the acid, basic, and neutral products of the destructive distillation of seaweed has yet been made; these have been under investigation for some time, but the well known difficulty of completely separating these interesting bodies in a state of purity has long delayed the publication of results.

I may state, however, that the products of distillation, as well as the charcoal from this source, in their chemical composition present little analogy with those of wood, peat or coal, and can only be chemically classed with those of bone.—I am, &c.,

EDW. C. C. STANFORD.

Glasgow, July 30, 1867.

OZONE.

To the Editor of the Chemical News.

SIR,—The following are the more salient points in the development of atmospheric ozone during the past three months:—

In April there was a marked period of ozone from the 4th to the 11th. Considerable amounts were present from the 1st to the 3rd, and on the 14th, 15th, and 21st. No ozone was found on the morning of the 18th, and very little on the 12th, 16th, 17th, aft. of 22nd, 23rd, 25th, and 27th to the 29th.

In May there were marked periods of ozone on the 14th, and 15th, and 25th. Considerable quantities were present on the 4th, 16th, 21st, 27th, and 28th. No ozone was found on the 10th, 20th, and 30th, and very little from the 1st to the 3rd, 6th to the 13th, 17th to the 26th, and 29th to the 31st.

In June there were two marked periods of ozone—the first from the 4th to the 8th, and the second from the 24th to the 28th. Considerable amounts were found on the 2nd, 12th, 20th, and 21st. Very little on the mornings of the 3rd, 10th, 13th, 14th, 16th, 18th, 19th, 22nd, 25th, 29th, and 30th, and throughout the day on the 27th.—I am, &c.,

R. C. C. LIPPINCOTT.

Bournemouth.

GAS FROM CHARCOAL.

To the Editor of the Chemical News.

SIR,—Your correspondent "G. L.," in No. 372 of your journal, asserts that I have been anticipated by Drs. Blumstrett and Reichardt in my discovery of the fact that the gas is nitrogen which escapes from recently ignited charcoal when immersed in water,—in answer to which I would desire to advise "G. L." that a notice of the receipt of my paper appeared in your journal for December 7, 1866. Allowing, therefore, for the length of time required for the transmission of postal information from here to your office, it will be perceived that not only was it impossible I could acquaint myself with the researches of these chemists, but that were I so inclined, I might reasonably contend for priority of discovery.

One question I beg to be allowed to ask of "G. L.," being unable as yet to examine the periodical alluded to.—Have Drs. Blumstrett and Reichardt proved—as I have—that *incandescent* charcoal absorbs nitrogen from the air?

Thanking your correspondent for his information in regard to my paper on "Soluble Vegetable Fibre," and for his courtesy throughout, but taking exception to the application of such terms as innumerable and exhaustive to the description of the researches of *any one*, however distinguished.—I am, &c.

WILLIAM SKEY.

Wellington, New Zealand, May 17, 1867.

MISCELLANEOUS.

Intercolonial Exhibition, 1866-7.—The shadow of the Paris Exhibition has, it is true, obscured somewhat the *éclat* of the similar event of the Southern World, but the history of the latter is well worthy of a short record. A few months ago, the Governor of Victoria publicly received the report of the jurors, and formally declared their awards at Melbourne. Up to the middle of February the number of admissions had been 242,892, which speaks well for the interest taken by the inhabitants of a thinly inhabited district in their national undertaking. A few notices of these awards will give a very fair notion of the character of this Exhibition, and will serve as a basis for comparison between it and similar European festivals. The public spirit shown in the Southern hemisphere cannot be mistaken, for it is most probable that this national work will remain as a permanent exhibition, while in England at the present time no decided step has been taken to secure any of the marvels of the Paris Exhibition for the public, the more valuable of which have already been bespoken by foreign governments. The most interesting department of course is that of the ores and non-metallic products, in which medals are allotted for nuggets, ingots, and granulated samples of gold and silver auriferous quartz and colonial gems. Antimony was exhibited in abundance, and native copper of a very superior character. Mr. G. Milner Stephens, F.R.S., received a medal for gems and precious stones; tin-ore, slate, and limestone, were exhibited, but by far the greatest interest is attached to the coal from Newcastle (neither upon Tyne, nor under Lyne), the shale from the Hartley Kerosene Oil and Paraffin Company, and the kerosene from the Western Kerosene Oil Company. Similar shales were sent from New South Wales and Tasmania, also coals from both; from the latter country also the most valuable topazes were sent. South Australia carries off the palm for the following valuable minerals: copper ores, bismuth, plumbago, cobalt and its ores. The ores from Western Australia, for which medals are awarded, were copper only. New Zealand produces, in common with the other colonies, gold and coals, with plumbago and *Titaniferous iron ore*, with novelties in the way of chromium ores and alum. The absence of all mention of platinum would lead us to the conclusion that it is almost the only metal of commercial importance not found plentifully

in Australia. The chemical products, when contrasted with the brilliancy of the preceding, are rather meagre, the leading items for which medals are awarded, being "a beautiful sample of higher tarascaci," colonial soft soap, and fluid magnesia. Several awards were made for photographic chemicals, one for commercial mineral acids from Victoria, two for colonial made ink, these with Moulder's coal-dust colonial made ink, and fine quality blackings, exhaust the products for which awards were made in this section of "Chemical and Metallurgical Products and Processes." In the section for horns, hoofs, bones, &c., we notice stearine candles, silicated soaps, anti-corrosive composition for ships' bottoms, superphosphate of lime, deodorising powder, Victorian guanos. The native oils and waxes possess a special interest, with sperm oil, black whale oil, spermaceti, &c. In another department many medals were given for preserved meats, and essence of beef, chiefly from New South Wales. Of general interest will be the awards of medals to Mr. Allport for salmon two years old, smolt and perch, to the Acclimatization Society for the Angola goats, alpacas, and llamas: we mention these especially to show the spirit that exists in the colony. The following are prepared in Australia now also—formerly imported from foreign countries—arrow-root, coffee, and spices in great abundance, starch, maizena, granulated potatoes, "a very valuable article for long voyages;" maccaroni and vermicelli are also commended as a good specimen of a new industry. The Netherlands India Society received medals for tea, coffee, nutmegs, and cloves. New Caledonia is very ably represented, thanks to the exertions of the eminent scientific workers, who have prepared specimens of gluten, starch, and sugar, from the various native plants of that colony. A separate class is formed for chemical and philosophical apparatus. We might prolong this notice to an indefinite length, but will allude only to the sections for native wines and liqueurs, glass manufacture, and photography, with photographs of the Aborigines. In conclusion, we may add that the interest taken by neighbouring States in it, has given to this Melbourne Exhibition quite an international character; every one of our Australian colonies exhibited, and products were also sent from the Mauritius and the French settlement of New Caledonia. The Australian Maraschino, brandy, Hermitage, and Burgundy, may perhaps attract attention even at Paris, where one of the best conducted English departments is imported directly from Melbourne; we allude to that of Messrs. Spiers and Pond, who, as recognized representatives of England at Paris, bear witness to the rapid strides in civilisation made by our Australian colonies.

"Artificial Gold."—The following alloy, "artificial gold," as it is called, has been lately the subject of correspondence in the *Mining Journal* &c., and is hailed as a grand discovery likely to serve the Cornish copper and tin mines, by introducing a new demand for these metals. The description here quoted is from the *Engineer*, of July 19, 1867, as follows:—"It is stated that an American has discovered a beautiful alloy, which has been most successfully applied as a substitute for gold; it is composed of pure copper, 100 parts; pure tin, 17 parts; magnesia, 6 parts; tartar of commerce, 9 parts; sal ammoniac, 3·6 parts; and quicklime, 1·6 part. The copper is first melted, then the lime, magnesia, sal ammoniac, and tartar are added, little at a time, and the whole is briskly stirred for about half-an-hour, so as to mix thoroughly, after which the tin is thrown on the surface in small grains, stirring until entirely fused. The crucible is now covered, and the fusion kept up for about thirty-five minutes, when the dross is skimmed off, and the alloy found ready for use. It is quite malleable and ductile, and may be drawn, stamped, chased, beaten into powder, or into leaves, like gold-leaf. In all of which conditions it is not distinguishable from gold even by good judges, except by its inferior weight. The alloy has already been largely applied in the United States, and requires only to be known in Great Britain to become a favourite."

The Metric System.—Interpretation of the Act of 1864.—During the past year a subject of some importance, involving the legal construction of the Metric Act of 1864, was brought to the notice of the Board of Trade. One of the inspectors of weights and measures for the county of Surrey stated that he had seized some metric weights in a tradesman's shop in Southwark, as being illegal. On his bringing the matter before the magistrates at the Newington Sessions House, the defendants alleged that the Metric Weights and Measures Act, 1864, 27 & 28 Vict. c. 117., permitted the use of metric weights, but gave the inspector no power to examine them. The magistrates dismissed the information, observing that the Act was loosely drawn, and they advised the inspector not to seize the metric weights, as the defendants were justified under the Act in using them. Upon this subject the Board of Trade directed a case to be prepared for the opinion of the law officers, who gave their opinion that, notwithstanding the provisions of the Metric Act, a person using material metric weights and measures is liable to have them seized, and to conviction and forfeiture of the weights, under the Act 5 & 6 Will. iv. c. 63.

Pharmaceuticals and the Jury Lists.—We have been requested to remind members of the Pharmaceutical Society, and others who may be entitled to claim exemption from serving on juries, that the churchwardens and overseers receive, during the month of July, the precept to return lists of persons qualified to serve on juries for the ensuing year; and that in August such lists are prepared and affixed to the church doors, &c. Pharmaceutical chemists should see that their names are not inserted in such lists, and, if inserted, should attend on the day of appeal and present their legal certificate of registration and exemption; such certificate may be obtained from the registrar of the Pharmaceutical Society, 17, Bloomsbury Square, on payment of rs.

Quekett Microscopical Club.—The second annual general meeting was held in the library of university college on Friday the 26th ult. Mr. Ernest Hart, President, in the chair. The report of the committee showed that the society now numbers 273 members, of whom 130 were elected during the year; that many papers of microscopic interest had been read, field excursions successfully carried out, and class instruction in the uses of the microscope afforded to the younger members. The treasurer's report gave a satisfactory balance and in every way the club was in a very prosperous state. The president delivered an address, in the course of which he congratulated the members on the remarkable success which had attended the operations of the year, and on papers having been read which would bear comparison with those of any other club. He urged the members to remember that the microscope was not only a source of amusement but an instrument of research, and it was its real use which ought rather to be cultivated. Amusement and research were not incompatible, and the contemplation of minute forms was in itself a means of recreation, but the true microscopist is he who looks through form and structure to discover uses and laws, who is never contented with endeavouring to ascertain what are its relations, merely with a view to systematizing, but as a means to an end. Whether we consider the study of the microscope as an intellectual amusement or look into it as teaching some of the very highest truths relating to law, order and power in the universe, we yield only to the convictions which are taught us whilst looking upon structure in relation to the causes which modify it. The following officers were elected for the ensuing year:—President, Mr. Arthur E. Durham, F.L.S. Vice-Presidents—Dr. Tilbury Fox, M.R.C.P.; Mr. Ernest Hart; Mr. William Hislop, F.R.A.S.; Mr. John K. Lord, F.Z.S.; Treasurer—Mr. Robert Hardwicke, F.L.S.;—Hon. Secretary—Mr. Witham M. Bywater.;—Hon. Secretary for foreign correspondence—Mr. M. C. Cooke;—Committee.—Mr. W. J. Arnold, Mr. N. Burgess, M. S. J. McIntire, Mr. J. Slade.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Monatsbericht der königlich-Preussischen Akademie der Wissenschaften. December, 1866.

EHRENBERG "Contributions to the Knowledge of the Formation of Organic Siliceous Deposits."

January, 1867.

BAEYER "On the Effect of Age on the Length and Coefficient of Expansion of Iron and Zinc Metrical Standards."

Kunst und Gewerbeblatt. February 1867.

O. REINSCH "On Colouring thin Sheets of Metal, and rendering Membranes, Fabrics, and Glass Iridescent." A. VOGEL "On the Assimilation of Silica by Plants." H. VOHL "On the Poisoning of Bread by the Use of Old Building Timber and Railway Sleepers for Heating Bakers' Ovens." A. L. TRENN "On a Substitute for Urine for Washing Wool."

No. 3. March.

E. ZEIGLER "On the Preparation of a Substitute for Animal Charcoal." H. AVET "On the Production of Printing Surfaces by Photography." C. H. SCHMIDT "On the Water Supply of Ludwigsburg." Paris Exhibition of 1867: Catalogue of Bavarian Products. "On the Use of Turpentine for Whitening Household Linen." "On the Electrolytic Deposition of a bright Layer of Silver." F. F. KUCKLA "Apparatus for testing the Inflammability of Petroleum." J. FUCHS "On the Use of Glycerine for impregnating Casks for holding Oil, Petroleum, and Turpentine." "Receipt for Copying Ink." "On Water Glass as an Ingredient for Cement."

Bulletin de La Société d'Encouragement. February, 1867.

CHATIN "Report on Mauban's Thermometer for ascertaining Temperatures at Different Depths." PARIS "On the Manufacture of Articles of Enamelled Iron." C. LAUTH "On the Manufacture of Aniline Black." BON "On the Manufacture of artificial Precious Stones." GUESNIER "A Method of Producing Castings having an External Coating of Hard Iron." GUIOT "A Thermoscopic Barometer." HAYREZ "An Improved Lixivating Apparatus." LACROIX "On the Manufacture of Colours for Painting on Glass." "On a dangerous Adulteration of Petroleum."

Journal für Praktische Chemie. March 28, 1867.

G. NADLER and V. MERZ "On Chinoline Blue." F. HOLM "On Hæmatoidine." G. STADELER "On the colouring Matter of the Yolk of Egg." F. HOLM "On the Chemical Constituents of the Suprarenal Capsules." W. DYPKOWSKY "On the Identity of Choline with Neurine." L. S. ISELSTROM "On some new Minerals from Wermland and Oerebro." BOTTGER "Experiments with Mialaret Becknell's Constant Battery." BOTTGER "On the Action of Water on Metallic Lead." G. STREIT "On the Preparation of Carbonate of Thallium."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

1212. E. Guenin, Henrietta Street, Covent Garden, Middlesex, "Improvements in the preparation and application of mustard for curative purposes." A communication from P. Rigolot, Paris. Petition recorded April 26, 1867.

1549. C. Sanderson, Worksop, Nottinghamshire, "Improvements in the manufacture or melting of cast steel."—May 24, 1867.

1583. W. Mitchell, Northwold, near Brandon, Norfolk, "An improved food for sheep and other animals."—May 28, 1867.

1628. A. G. Schaeffer, Gloucester-street, Newcastle-on-Tyne, "Improvements in the apparatus increased light in the combination of illuminating matters."—June 1, 1867.

1635. W. H. Richardson, Glasgow, N.B., "Certain improvements in the manufacture of iron and steel, and in the means or apparatus for effecting the same."—June 3, 1867.

1646. E. Meldrum, Bathgate, Linlithgow, N.B., "Improvements in the purification of paraffine."—June 4, 1867.

1655. G. White, Queen Street, Cheapside, London, "Improvements in the manufacture of hydrate and carbonates of soda."—A communication from F. Bian, Turin, Italy.—June 5, 1867.

NOTICES TO PROCEED.

325. J. Wright, and T. Copley, Cophthall Court, Throgmorton-street, London, "Improvements in the treatment of ores of lead for the purpose of obtaining salts and colours of the same."

337. J. Graham, Manchester Road, Warrington, Lancashire, "Improvements in the manufacture of spelter from zinc ashes and refuses, obtained when coating iron with zinc." Petition recorded, February 6, 1867.

344. G. E. Pain, High Street, Camden Town, and C. Corry, Dean Street, Soho, Middlesex, "Improvements in the preparation of oils for luminoting, lubricating, and other purposes for which they may be applicable." February 7, 1867.

1412. H. A. Bonneville, Rue du Mont Thabor, Paris, "An improved washing powder." A communication from L. Lacalm, and B. A. Gayot, Aubin, France.—Petition recorded May 13, 1867.

NOTES AND QUERIES.

Stearic Acid in Paraffin.—Sir,—Is there a test for the presence of stearic acid in paraffin?—X.

Oxidation of Aniline.—Sir,—I should feel obliged to any of your readers who would give me the name and formula for the crystals resulting from the action of bichromate of potash on an acid solution of sulphate of aniline.—C12H7N.

Wires for Micrometers.—Sir,—If any of your ingenious readers can suggest anything which can be used for the purpose of micrometer wires for the microscope, they will confer a favour on the undersigned. At present spider threads, fine platinum wire, and diamond marks on glass are used, but they are all open to objections.—O. RAMSBOTTOM.

Nitrogen.—Sir,—I require absolutely pure nitrogen gas for some experiments. I have instituted a few trials of different methods which appear likely to be successful, but it has occurred to me that, perhaps, a few lines from one of your correspondents may save me the trouble of further investigation. I may state that the purpose for which I require the nitrogen makes me anxious not to prepare it from air. Is there any way of liberating it from a solution or mixture so that the amount and velocity of the supply may be varied at will?—THETA.

Hardening Steel.—Sir,—It has recently been mentioned that file makers at Sheffield prefer, for hardening their steel goods, water that has been for a long time in use. They say "old water hardens much better than new water;" and amongst the acts occasionally indulged in by workmen against their employers, that of making a hole in the hardening tank and letting the water run away, is considered to inflict injury for some considerable time. Is there any foundation for this opinion?—A SHEFFIELD BLADE.

Commercial Testing of Aniline Colours.—Sir,—The ordinary method of determining the value of these colours, viz., dyeing swatches of equal weight and of equal quantities of the various samples in question, is quite satisfactory for reds and blues, but fails completely for purples, violets, and all intermediate shades. The reason is that these colours, instead of being homogenous, are now frequently made by mixing an ordinary "magenta" with *bleu de Lyons* in the required proportions, or, in other cases, by adding to a violet or purple colour a little magenta or aniline blue, to alter the shade according to wish. Now, a mixed colour of this kind may dye a swatch in the most satisfactory manner, but when 'used in the large scale the goods first put into the pan and those entered last will have quite different shades, owing to the unequal affinities of the colours for the fibre, and to their different behaviour with the other substances present. The method which I employ to determine whether an aniline violet is homogenous or a mere mixture, is the successive application of different solvents. Thus a sample of this nature was treated with hot water and filtered. The filtrate exactly resembled a solution of common magenta in hot water, and gave a worsted the colour which such a solution would produce. The residue, insoluble in water, was then dissolved in alcohol, and was found to be an ordinary aniline blue. If a mixed colour is dissolved in spirit and diluted with water, a drop of the liquid let fall upon white blotting paper will exhibit concentric rings of colours.—W.

ANSWERS TO CORRESPONDENTS.

Pharmacist.—The substance is incorrectly described as *crystallised*. It is a scaled preparation, to which that term is inapplicable. Lombardy.—Consult any elementary book on chemistry.

M. Meller.—The mineral kindly forwarded by our correspondent unfortunately contains no trace of thallium.

J. W.—Add shellac to the solution of india rubber in naphtha—that will confer on it the desired property.

A Constant Reader.—From what we can gather from your long and involved statement, you have not been careful enough to remove free mineral acids from your solution. This has prevented the complete precipitation of the phosphate, and some having consequently passed through, has complicated the subsequent reactions. You can easily test the correctness of your supposition by trying whether the precipitate which ought to be yttria contains phosphoric acid.

Beta.—The alkaline stearates are very slightly soluble in water.

J. Maxwell.—Use a bath of tin, to which bismuth has been added, until its melting point is reduced to about 439°F, cover the bath with paraffin to prevent oxidation (powdered charcoal is of no use), and watch the indications of a thermometer immersed in the melted metal.

Laputa.—A mixture of tallow and black-lead is very effectual as a lubricant for gas taps and metallic rubbing surfaces in general.

J. Fellick.—Leaf-gold is generally about 1-250,000th of an inch in thickness.

C. Charles.—Water your gravel walk with a solution of sulphate of iron, this will in all probability improve its colour.

Letters are waiting at our office for "J. C." W. P. Meaden, "Manufacturer," "F. G. H.," and "Alpha."

Communications have been received from J. Carter Bell (with enclosure); William Skeay, ditto; H. S. Bethell; F. Maxwell Lyte; the Abbé Moigno; Professor Heaton; F. Tomlinson; J. Heath (with enclosure); W. Edmonds; Rev. B. W. Gibson (with enclosure); H. Watts, F.R.S.; A. P. Hurlstone; F. Ford (with enclosure); G. Marrison, Tasmania (with enclosure); F. Day; C. Tomlinson, F.R.S.; F. Avelino Aramayo; C. R. A. Wright; J. Sutherland (with enclosure); James Carruthers; James Owen; May and Baker; Professor G. C. Foster; J. Spiller; J. W. Slatter (with enclosure); Messrs. Townsend and Adams, New York (with enclosure); W. W. Renny; J. Henderson, junr.; P. Anderson; J. A. Lake Glog; E. C. Stanford; John Dods (with enclosure); R. F. Bright; E. Brembridge; Benjamin Wheeler; G. W. Wigner; John Lundy (with enclosure).

SUPPLEMENT TO THE CHEMICAL NEWS.

VOL. XVI., No. 400.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

ON THE ABSORPTION OF GASES BY METALS.

By Dr. ODLING, F.R.S., &c.

(Concluded from p. 35).

You observe in the case of all the metals we have as yet considered, that they are characterised by absorbing chiefly one particular gas. Platinum and palladium are characterised by absorbing hydrogen alone; and copper also, by absorbing hydrogen. Whether it absorbs any other gases has not, I believe, been determined. In the case of gold, the gas absorbed most abundantly is hydrogen, though it is certainly capable of absorbing a great many others. Now, with regard to silver, we find that it has the special property of absorbing oxygen gas. I am not referring to the temporary absorption of oxygen by melted silver, and its evolution on the solidification of the metal, which constitutes the well-known spitting of silver, but to the occlusion of the gas by the solid metal—for it is not merely an absorption, it is an occlusion, the metal retaining the gas for any length of time; and you will remember that, when speaking of platinum, I mentioned that the metal retained its hydrogen for two months, although exposed freely to the air. In different experiments, then, silver wire was found to absorb 74 per cent of oxygen, and nearly 21 per cent of hydrogen. Silver sponge absorbed 722 per cent of oxygen; 92 per cent of hydrogen; 52 per cent of carbonic acid, and 15 per cent. of carbonic oxide. A specimen of silver leaf exposed to the air at a red heat absorbed 137 per cent of oxygen and 20 per cent of nitrogen. Accordingly, while ordinary atmospheric air contains 21 per cent of oxygen, and the air absorbed by gold only 5 per cent of oxygen, in the air absorbed by silver the oxygen amounts to 85 per cent.

Now we come to another metal, and one of very great interest in relation to this occlusion of gases—namely, iron. Ordinary iron wire was carefully cleaned, heated in vacuo to drive off its natural gas, and then charged with different gases at a red heat. It was found that the wire, treated in this way, absorbed 46 per cent of hydrogen; but there was another gas which it could absorb in a much larger proportion—namely, carbonic oxide. Just as platinum is distinguished by its copious absorption of hydrogen, and silver by its absorption of oxygen, so is iron distinguished by its ready absorption of carbonic oxide. Whereas it absorbed only 46 per cent of hydrogen, it actually absorbed 415 per cent of carbonic oxide.

A point of interest connected with iron, as with platinum, is that the metal, though perfectly impervious to gas at ordinary temperature, yet when strongly heated, allows the passage through it of hydrogen gas, as shown by M. Deville, and of carbonic oxide, as shown more especially by Mr. Graham, whose admirable elucidation of the nature of these transmissions, forms the subject of our consideration this evening; and who has shown that in the case of iron, as in that of platinum, the transmission of the gas is preceded by its absorption in the substance of the metal.

With regard to the natural gas of iron wire,—that is to say, the gas existing in the metal as ordinarily met with,—I may direct your attention to the particulars of one or two experiments. In one experiment, the wire heated in vacuo was found to give off 7.94, which we will call 8 times its volume of gas, while in another experiment, in

which the heating process was kept up for a much longer time, it gave off 12 times its volume, or 1200 per cent of natural gas, consisting chiefly of carbonic oxide. Whence it would appear that ordinary wrought iron occludes in the forge, and continuously retains, from 8 to 12 times its own volume of natural gas.

Now iron has two distinct origins. In addition to what we may call terrestrial or telluric iron, there is another kind of iron which we may call sidereal, that is to say the iron of meteorites. Hence it became a question of interest to ascertain whether this meteoric iron contained any gas, and if so, what was the nature of the gas; because it would appear, from the existence in the different metals examined of what may be called natural gas, that every metal contains a residue of the gas in which it last existed at a temperature of ignition. If the metal has been last ignited in hydrogen it retains hydrogen, if the metal has been last ignited in carbonic oxide it retains carbonic oxide. Does meteoric iron then contain any gas? and if so, of what kind? For the purpose of ascertaining these points, a quantity of meteoric iron from the Lenarto fall, of about 45 grammes by weight, and six cubic centimetres by volume, was taken, cleaned, and introduced into a porcelain tube of this kind. A vacuum was made in the tube, and heat then applied, when so soon as the meteorite got red-hot, it began to give off some gas; and here, in this repetition of the experiment, I hope to show you some of the gas which this meteorite has brought down from—who can say where. There we have the porcelain tube, containing the meteorite, exhausted by the air-pump and being heated by the furnace. One end of the tube is closed; the other end connected as you see with the Sprengel pump. The mercury is now falling in the Sprengel pump, and as it falls is delivering the gas. In this test-tube we are now collecting the gas extracted from the meteorite, and which the meteorite has brought down from the place where it last was at the temperature of ignition.

Now comes the question, what is the nature of this gas? Well, the 45 grammes or 6 cubic centimetres of iron were ignited in this way for two hours and a half, and during those two hours and a half, they gave off 60½ cubic centimetres of gas, which I may say at once consisted substantially, not of carbonic oxide—the gas existing in terrestrial iron which has been last ignited in a coal furnace—but it consisted substantially of hydrogen, or contained, at any rate, 85½ per cent of that gas, with a small quantity of carbonic oxide and nitrogen. Whereas, then, telluric iron contains carbonic oxide absorbed from the atmosphere in which it has been last ignited, this sidereal iron contains hydrogen instead, absorbed, I suppose, from the atmosphere in which it has been last ignited. My distinguished friend, Dr. Miller, in co-operation with Mr. Huggins, has demonstrated the existence of hydrogen gas in celestial bodies by an analysis of the spectra of several of the stars; but we have got, in this test-tube, the thing itself. Here is the free hydrogen gas which has been brought down to us by one of these smaller stars. Perhaps a point of still further interest, relating to this subject, is the classification of the stars according to their spectra, which Father Secchi has recently made. He has divided the fixed stars into three classes, in one of which, typified by α Lyrae, the spectrum is essentially the spectrum of hydrogen. That star, then, undoubtedly contains an atmosphere, of which the prevailing constituent is hydrogen gas. Now, upon a subject of this kind, which is only three days old, it is not in human nature to avoid speculating a little; and I think we may venture to speculate thus far, that our meteoric iron probably absorbed its hydrogen from a star-atmosphere of the class which is so typified.

But there is another point bearing upon this subject. Under ordinary circumstances, we are not capable of getting into iron more than half its volume of hydrogen; but this natural iron contains nearly three times its volume of hydrogen. Now, if under ordinary atmospheric pres-

sure, iron will absorb only half its volume of hydrogen, what sort of a pressure would it require to enable it to absorb six times that quantity? According to our present notions, it must at any rate have been exposed to an atmosphere in a very condensed state. We can not imagine that, in the interplanetary space of our ordinary solar system, there should be gas of a sufficient density to permit the absorption by this meteorite of six times the quantity of hydrogen absorbable by iron under the pressure of our telluric atmosphere.

We have now succeeded in extracting a considerable volume, many cubic centimetres, of gas from our ignited meteorite. I almost think, although the experiment is but a small one, that, as we have hydrogen brought from so great a distance for our examination, it is worth while to darken the theatre in order to witness its combustion; and having lowered the theatre-gas, we will now inflame our hydrogen of the stars. [The meteoric hydrogen was accordingly ignited.]

So much, then, for the great fact of the absorption and occlusion of different gases by metals. Now we have to consider what is the nature of the absorption. In the year 1823, Mr. Faraday established the general proposition that a gas was nothing else than the vapour of a volatile liquid, existing at a temperature considerably above the boiling point of the liquid. In the case, for instance, of liquid water, which boils at 100° , if the vapour of this water be afterwards heated up to a temperature of 150° , the water-vapour existing at the temperature of 150° is a true gas, possessing all the physical properties of a gas. If we take this water-gas existing at 150° , and cool it down to a little above the temperature of 100° , it loses some of the characteristic properties of a gas, and becomes what we more strictly call a vapour; and this vapour, if subjected to a temperature ever so little below 100° , at once becomes converted into liquid water. Accordingly, the boiling part of liquid water may be equally well called the condensing point of water-gas; and similarly, in the case of other gases, their respective condensing points are merely the boiling points of the liquids producing them. But the boiling point of a liquid, and the condensing point of its gas, is not a fixed point of temperature, but is a point of temperature varying with the pressure to which the gas or liquid is subjected. For instance, under ordinary atmospheric pressure, water boils at 100° , but, under the pressure of five atmospheres it boils at 150° , so, that if we take our water-gas existing at 150° , and maintaining its temperature at 150° , then subject it to a pressure of five atmospheres, its temperature will no longer be above the temperature of its boiling point, and it will cease to exist as a gas at all, and become converted into liquid water. Accordingly, we may effect the condensation of water-gas, existing at any temperature, by cooling it down to its ordinary condensing point, or by subjecting it to a degree of pressure at which its existing temperature will not exceed that of its thereby heightened condensing point. And so with other gases. Every one of the very many different gases known to chemists, with about six exceptions, has been condensed into the liquid state, by a certain reduction of temperature; or by a certain increase of pressure; or by a conjoint reduction of temperature and increase of pressure, until the temperature of the gas has been brought below the heightened condensing point or boiling point corresponding to the increased pressure.

Now let us consider more minutely, for a minute or two, the effect of pressure upon these condensable gases, taking water-gas as an illustration. Suppose we take water-gas existing at 150° , and contained in a cylinder closed in by a movable piston, which is balanced, or weightless. Supposing the area of the piston to be one square inch, the water gas is subjected to a single atmospheric pressure, which is equivalent in this case to 15lb. Now if we place a 15lb. weight upon the piston, we shall double the pressure, and consequently halve the volume of our water-

gas. In order to reduce this gas to one-fifth of its original volume, we shall have to quintuple the original pressure, by placing four such weights upon the piston. But at a pressure of five atmospheres the temperature of the gas, or 150° , would cease to be above the temperature of its condensing point; and the gas, instead of being merely compressed into one-fifth of its original volume, would cease to exist as gas at all, but become converted into a scarcely appreciable volume of liquid, and the piston would descend to the very bottom of the cylinder. Accordingly water-gas at 150° , being condensable by a pressure of five atmospheres, it is impossible to reduce it to one-fifth of its bulk without liquefying it. And, similarly, with other gases. Ordinary ammonia gas being, at ordinary temperatures, condensable by a pressure of seven atmospheres, it is impossible to reduce it to one-seventh of its volume without liquefying it. Take, again, the case of sulphuretted hydrogen gas. That being condensable at ordinary temperatures, under a pressure of 15 atmospheres, it is impossible to reduce it to one-fifteenth of its bulk without liquefying it. Hydrochloric acid gas being condensable at ordinary temperature by a pressure of 40 times the ordinary atmospheric pressure, it is impossible to compress this gas into one-fortieth of its bulk without reducing it to the liquid state. And, in general, a gas maintained at some definite temperature, can not be reduced to a bulk less than that corresponding to the pressure necessary to liquefy it, without its becoming liquefied. Conversely, the reduction of any gas to a bulk less than that corresponding to the pressure necessary to liquefy it, must be taken as evidence of its liquefaction.

Now, although oxygen and hydrogen gases have never yet been reduced to their liquid state by mere pressure, there is strong reason to believe that these and other gases, absorbed by heated metals, really exist as liquids, or, at any rate, do not exist as gases within the substance of the absorbing metals. For these two gases have never been reduced to less than $\frac{1}{250}$ th of their bulk by mere pressure, but when absorbed by massive iron, platinum, &c., they are seemingly reduced in bulk many thousand-fold. Moreover, all gases, even the most insoluble, are certainly liquefiable by solution. Here I have an experiment arranged to show the liquefaction of gases by solution and absorption, with a view to suggest the analogy subsisting between the absorption of gases by liquids and by heated metals. This sealed tube is filled with ammonia gas, and on breaking the end of the tube under coloured water, you observe that the gas is absorbed in an instant, the water rushing up to the very top of the tube. Now ammonia is one of the most soluble of all known gases, but, notwithstanding its great and rapid absorption, which you have just witnessed, it is in reality less soluble in, or absorbable by water, than hydrogen is absorbable by palladium. At mean temperature one volume of water absorbs about 780 volumes of ammonia, whereas one volume of palladium absorbs 643 volumes of hydrogen measured at 17.5° , which would exceed 800 volumes measured at 97° , the temperature of the experiment.

Now, this absorption of soluble gases is manifested, not only in the case of liquids, but also in the case of soft solids; those which Mr. Graham has denominated "colloids." Accordingly, if we take a little hard white of egg, a substance which is not wet in the ordinary sense of the word, and if we pass it up into ammonia gas, you see that the white of egg absorbs the ammonia gas with almost as much rapidity as did water itself. Now one possible view, in connection with the absorption of gases by heated metals, is that these metals are in what may be termed a colloid state—that is to say, that they are soft bodies, or imperfect solids, and that a species of low form of chemical action takes place between the metal and the gas, allied somewhat to the low form of chemical action which leads to solution, or to the absorption of gas by soft solids, such as white of egg and india-rubber.

There is one further point to which, in the few minutes that remain to me, I wish to draw your attention, and

that is the absorption of gases by such substances as charcoal, for it is a question whether the absorption of gases by heated metals may not be allied in some degree to this well-known phenomenon; and certainly there are some facts, at any rate, which seem to indicate a very close relationship between the two acts of absorption. If we take a piece of compact charcoal, and pass it under metallic mercury into a cylinder of ammonia gas, we see in this case a somewhat rapid absorption of the gas; and I have no doubt that, in the course of a few minutes, the piece of charcoal will absorb the whole of the gas originally existing in the cylinder. Now, we know that this absorption of gas by charcoal varies considerably with the temperature of an experiment, the nature of the gas, and above all with the texture of the charcoal employed, just as does the absorption of gas by metal. Thus, in the case of platinum, the fused metal absorbs but a very small quantity of hydrogen, the spongy metal absorbs a larger, but still a comparatively small proportion; whilst the feebly porous metal, in the form of wrought platinum, alone manifests the property of absorption in the highest degree. Again, it is well known that the gases absorbed into charcoal have their chemical properties intensified, just as I have shown you with regard to the hydrogen absorbed by palladium. Further, the property of charcoal to absorb different gases is intimately related to its property of exerting a selective absorption of liquids and dissolved substances. Now we find this property also manifested by palladium. Thus 1,000 volumes of palladium foil were found to absorb 1 volume of water, $5\frac{1}{2}$ volumes of alcohol, and $1\frac{1}{2}$ volumes of ether, results showing a special relation of palladium to those different liquids, corresponding to the action manifested by charcoal. Moreover, this selective absorption of different liquids by a sort of capillary affinity, brings the absorption of gases by palladium into relation with some very familiar phenomena, at first sight of a widely different character, namely, the selective absorption of dyes by different tissues, and the action of mordants; the property which charcoal has of abstracting various matters from solution, being closely allied to that by which certain tissues and mordants abstract colouring matter.

There are many other points of very considerable interest, in relation to this subject, which I should be glad to bring before you, were not my time already expired; but there is one point of practical importance, connected with the absorption of gases by iron, which I ought not to omit, namely, the bearing which these facts have upon the conversion of iron into steel. Steel is manufactured, as we all know, by the application of charcoal to bar-iron at a certain temperature. The charcoal, it is true, gets partly converted into carbonic acid and carbonic oxide, but it is only the surface of the iron which is in contact with either the charcoal or its oxides; nevertheless the conversion of the metal into steel takes place through its entire mass. Now, it has hitherto been a subject of great difficulty to explain this penetration of the carbon, or carbon-oxides, into the centre of the iron bars. But we now see that iron, like a colloid or porous substance, has the power of absorbing carbonic oxide gas to its very centre. And it would seem that the process of acieration—the conversion of iron into steel—really consists in an absorption of carbonic oxide by the metal, and a subsequent decomposition of the absorbed carbonic oxide, into carbon, which effects the conversion of iron into steel, and into carbonic acid gas, which escapes from the surface of the metal, and gives rise to the blisters by which freshly made steel is characterised. The eliminated carbonic acid then takes up more carbon, to become reconverted into carbonic oxide, which the metal again absorbs, and so on continuously until the process is completed.

In conclusion, it only remains for me to express what I am sure we must all feel—our sense of indebtedness to Mr. Graham for his admirable investigations, which

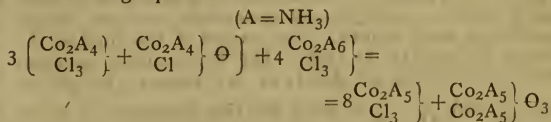
have not only added largely to our knowledge of the transmission of hydrogen through ignited platinum and iron, observed by M. Deville, but have gone very far to explain the nature of the phenomena, by showing that they differ altogether in character from the phenomena of diffusion, but are preceded by an occlusion and probable liquefaction of the gas in the substance of the metal, somewhat similar to the occlusion of soluble gases by water, or of absorbable gases by charcoal, in virtue, probably, of a low form of chemical affinity subsisting between the gas and the metal. They have brought to light the startling fact of the occlusion of some of the lightest gases by some of the heaviest metals, to the extent of several times their volume, and, in the case of palladium, to the extent of several hundred times its volume. They promise, moreover, to throw great light upon a very important branch of manufacturing art—namely, the conversion of iron into steel. They have also given us a new illustration of the strange relationship so frequently existing between apparently the most remote phenomena, as the acieration of a piece of iron and the dyeing of a piece of silk. And, lastly, in the case of the meteoric iron, they have afforded us a further demonstration of the oneness of the universe, of the extension of one chemical system throughout the entire cosmos.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

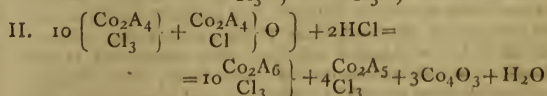
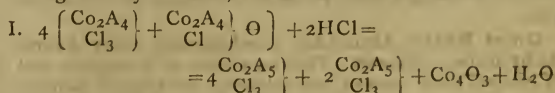
Ammoniacal Cobalt-bases, Modes of Formation of.—C. D. Braun. 1. To a solution of cobaltic chloride or nitrate is added solid ammoniac chloride and aqueous ammonia, the mixture is well shaken, plumbic peroxide added, and the whole boiled for half-an-hour. The solution then contains chiefly hexammonio-cobaltic chloride, which is precipitated in crystals on addition of chlorhydric acid.

2. A moderately strong solution of cobaltic nitrate is well shaken with strong ammonia, pure indigo-blue (prepared according to Fritzsche's method) added, and the mixture boiled; on cooling crystals of pentammonio-cobaltic chloride are obtained.

3. Tetrammonio-cobaltic oxychloride, hexammonio-cobaltic chloride, and aqueous ammonia, heated together under pressure, form pentammonio-chloride, according to the following equation:—



4. The reaction, by which from tetrammonio-oxychloride plus chlorhydric acid, is obtained hexa- and pentammonio salt (Schiff, Fremy) the author explains by the following two equations, the first representing the action of strong chlorhydric acid, the second that of diluted:—



5. Penta- and hexammonio compounds may also be obtained by acting upon xantocobaltic salts with strong ammonia, or by dissolving in them ammoniac chloride and heating.—(*Ann. Chem. Pharm.*, cxlii. 50).

Toluolsulphurous Acid.—R. Otto and O. V. Gruber. Toluolsulphurous acid ($C_7H_8SO_2$) according to these,

is prepared by acting upon sulphotoluic chloride in ethylic or benzoic solution with sodium-amalgam, and decomposing the sodic salt, thus formed, with chlorhydric acid. It crystallises from water in large, white, rhombic plates, resembling benzoic acid; dissolves readily in alcohol, ether, or benzol; fuses at 85°, and decomposes above 100°. Exposure to moist air converts it into toluol-sulphuric acid



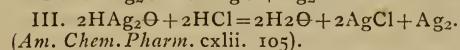
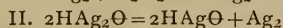
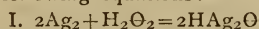
The salts of toluolsulphurous acid are crystallisable and mostly soluble in hot water or alcohol; its ethylic ether is an oily liquid.

Bromine substitutes an atom of hydrogen, forming brom-sulphotoluol



Chlorine acts in a like manner, furnishing a chloride identical with that obtained in the ordinary manner (from phosphoric chloride and sodic sulphotoluolate), and giving with nascent hydrogen Märker's metabenzylsulphhydrate.—(*Ann. Chem. Pharm.*, cxlii., 92.)

Argentie Hydrates.—C. Weltzein. Silver dissolves in a neutral solution of hydric peroxide with disengagement of oxygen and formation of a small quantity of a blueish gray precipitate. The solution contains argentous hydrate ($\text{Ag}_2=216$), and is not precipitated by sulphuretted hydrogen nor immediately by chlorhydric acid; the precipitate formed after some time consists of a mixture of chloride and metallic silver; potassic hydrate produces a dark brown precipitate. When left exposed to air, the solution assumes a reddish brown colour, and becomes turbid from silver being separated. When evaporated to dryness and extracted with water, a residue of metallic silver is left, and a solution obtained which now contains argentic hydrate ($\text{Ag}=108$). This solution has a slightly alkaline reaction, and is at once precipitated with chlorhydric acid. The nature of these reactions is shown in the following equations:—



Oxidation of Alcohol.—C. F. Schönbein. The presence of certain hydrocarbons in alcohol greatly accelerates the oxidation of the latter. When absolute alcohol is mixed with pure oil of turpentine, or a similar substance, and exposed to sunlight and atmospheric oxygen, hydric peroxide is soon formed. The nature of this process the author believes to be this:—The hydrocarbon polarises the oxygen of the air, that is to say, causes it to split up into $\bar{\text{O}}$ and $\bar{\text{O}}$. $\bar{\text{O}}$ is used for the formation of resin,

formic acid, etc., and $\bar{\text{O}}$ combines on the one hand with the hydrocarbon, forming a compound similar in constitution to hydric peroxide; on the other, oxidises the alcohol, forming hydric peroxide.—(*Journ. pr. Chem.*, c. 469).

Oil of Bitter Almonds, combination with Acetic Anhydride.—Hübner. The researches of Limpricht and of Neuhofer have proved the identity of diacetic benzol, derived from benzoic chloride and argentic acetate, with the compound obtained from chlorinated toluol; but it remained to be decided whether this compound is also identical or only isomeric with the body, first obtained by Geuther from oil of bitter almonds and acetic anhydride, the latter having been obtained as an oil, differing in that respect from the true diacetic benzol which crystallises readily. Hübner has repeated Geuther's experiments, and confirmed the latter chemist's statements, but adds, that the smallest fragment of a crystal of diacetic benzol brought in contact with the oil, causes it to crystallise

immediately, and after several recrystallisations from ether it shows the melting point (44°–45°), and all other properties of diacetic benzol $\text{C}_7\text{H}_6(\text{C}_2\text{H}_3\text{O}_2)_2$.—(*Zeitschr. Ch. N.F.* iii. 277).

Pyrrrol, Preparation and Oxidation of.—M. Goldschmidt prepares pyrrrol by heating ammoniac mucate with glycerine in a retort to 180°–200°. At that temperature the decomposition of the mucate into ammoniac carbonate and pyrrrol takes place with great regularity. This method is likewise preferable to that of dry distillation, on account of the larger quantity and superior quality of the product obtained. Pyrrrol reduces argentic oxide, being converted thereby into a well defined acid which is soluble in water, alcohol, or ether, forms precipitates with silver and lead, and sublimes in needles.—(*Zeitschr. Ch. N.F.* iii. 280.)

Gallic acid, Bromo-derivatives of.—M. E. Grimaux. Bromine substitutes readily one or two atoms of hydrogen in gallic acid, forming mono- and di-bromgallic acid = $\text{C}_7\text{H}_3\text{BrO}_5$ and $\text{C}_7\text{H}_4\text{Br}_2\text{O}_5$. Both are readily soluble in boiling, sparingly in cold water, soluble in alcohol and in ether.—(*Comptes R.* lxiv. 976.)

Tantalum, Atomic Weight and Compounds of.—R. Hermann believes the composition of tantalic chloride to be TaCl_2 , for with this assumption the vapour-density, as found by Deville, 9.6 agrees with the calculation, which requires 9.66. The atomic weight of tantalum based upon this formula is 860. To these considerations is added a compilation of all known compounds of tantalum, including several new ones, in regard to which the reader is referred to the original paper.—(*Journ. Pract. Chem.* c. 385.)

Toluol, Chloro-derivatives of.—O. Pieper. Toluol, saturated with chlorine, separates on standing crystals of the composition $\text{C}_7\text{H}_6\text{Cl}_8$. They fuse at 150°, are insoluble in water, sparingly soluble in alcohol, more so in ether, but they dissolve readily in carbonic bisulphide. Sodic hydrate in alcoholic solution decomposes the new compound readily at 110°, and on adding water to the product of decomposition a brown oil separates, the aqueous solution containing small quantities of an acid which seems to be dichlorodracylic acid, $\text{C}_7\text{H}_4\text{Cl}_2\text{O}_2$. The oil after purification is colorless, distils at 280°–290°, and has the composition $\text{C}_7\text{H}_4\text{Cl}_4$.—(*Ann. Chem. Pharm.* cxlii. 304.)

Specular Iron made at Biber (Hepia), and used, with great success, for the production of cast steel cannons, being dissolved by electrolysis in hydrochloric acid, was found to contain (according to Bagh) the following substances:—

Carbon	3.758
Iron	87.997
Manganese	6.555
Phosphorus	0.578
Silicon	0.497
Sulphur	0.171
Calcium	0.127
Copper	0.120
Arsenic	0.118
Magnesium	0.052
Antimony	0.027
Silver, lead, bismuth,	trace.

—*Ann. d. Chem. u. Pharm.* bd. 140, p. 180.

Blast Furnace.—To increase the production of iron blast furnaces six-fold, Morgan gives them greater dimensions; for instance, 9½ metres in diameter, blowing into the furnace by 12 tuyeres. A hollow cone is besides constructed in the middle part of the bottom of the furnace, by means of which a blast is also introduced into the furnace.—*Revue Univers. X. ann.*, 4 livr., p. 62.

THE CHEMICAL NEWS.

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ON THE ANALYSIS OF CAST IRON.

By EDMUND G. TOSH, Ph.D.

BEFORE proceeding with the regular analysis of cast iron, I have examined some of the more important processes for the estimation of the numerous substances which make up its constitution. The analysis of cast iron is one of the more difficult operations of analytical chemistry, and to ensure accuracy many special precautions and much extra manipulation are necessary—not because the ingredients are of themselves difficult of determination, but because the quantity of iron in every case preponderates so largely over that of the other elements.

In comparing the merits of the various processes one specimen of iron was used throughout.

Estimation of Carbon.—The estimation of this element as it occurs in iron is a problem which has engaged the attention of many celebrated chemists. Connected with the literature of the subject we find the names of Berzelius, Karsten, Wöhler, Gay-Lussac, Regnault, Caron, and numerous others, but notwithstanding the labour which has been expended in this direction, we have not arrived at a method which does not necessitate a large amount of time and work for its satisfactory accomplishment.

*a. Regnault's method,** with the modifications of Bromeis, † is thus carried out. About two inches of a combustion tube of hard Bohemian glass, closed at one end, are filled with a mixture of equal parts of chromate of lead and chlorate of potash. 3 grms. of the iron under examination, in a state of very fine division, are intimately incorporated with 50 grms. of a mixture of 40 parts of chromate of lead, and 6 parts of previously fused chlorate of potash, and introduced into the combustion tube, and lastly a layer of chromate of lead. To the tube a chloride of calcium and a Liebig's potash apparatus are attached; the former to retain traces of moisture, the latter to absorb the carbonic acid formed. The combustion tube is cautiously heated, first near the open end as in the conduction of organic analysis. When the mixture of the iron with the lead salt is brought to a dull red heat, the metal burns with incandescence, and the carbon is oxidised to carbonic acid, which is absorbed by the potash solution. At the close of the operation the mixture at the extreme end of the tube is heated, oxygen is evolved, all carbonic acid is driven forward, and the last traces of carbon consumed. From the increase of weight of the potash apparatus, due to carbonic acid, the amount of carbon may be calculated. In this way Regnault obtained very concordant results, which were afterwards confirmed by the experiments of Bromeis. I made two estimations by this process, and the results agree well with one another.

1. 3.240 grms. of iron gave 0.462 gm. CO₂ equal to 3.886 per cent of carbon.
2. 3.8245 grms. of iron gave 0.5605 gm. CO₂ equal to 3.996 per cent of carbon.

I have reason to think, however, that the percentage of carbon indicated, is somewhat too low in both cases, on account of loss of carbon during pulverisation of the iron. This loss, as pointed out by Morfit and Bobth, ‡ is often appreciable, and in the case of highly graphitic

iron, very considerable. With this one exception, the process is in every respect commendable, and where, as with spiegeleisen or white iron, this loss of carbon cannot take place, it strongly recommends itself. When instead of a mixture of chromate of lead and chlorate of potash, chromate of lead is used alone, no very reliable results can be obtained, and invariably the amount of carbon shown by this method is too small.

b. Fresenius's Method.—A weighed portion of the metal, in borings or chippings, is dissolved in dilute sulphuric acid by the aid of heat. The gases evolved during solution, consisting mostly of hydrogen, are passed over red-hot oxide of copper. The gaseous hydrocarbons are burned, and the carbonic acid formed, after drying by chloride of calcium, is absorbed by potash solution in a Liebig's apparatus, and thus weighed. Fresenius states that in cases where the percentage of combined carbon is very low, this process may be used for its direct estimation. Where an estimation of the total carbon is required, the matter insoluble in the dilute sulphuric acid, remaining behind in the flask, is collected and burned in a stream of oxygen, and from the weight of the resulting carbonic acid, the amount of carbon may be deduced. This quantity, added to that obtained by burning the gases over oxide of copper, gives the total quantity of carbon contained in the iron. In drying the insoluble residue previous to combustion in oxygen, an elevated temperature must be carefully avoided, as I have occasionally noticed that at a temperature of about 100° C., this insoluble matter gives off a strong-smelling, disagreeable vapour, in all probability a volatile hydrocarbon, formed by the contact of hydrogen and carbon in the nascent state. At a temperature of about 80° C. the odour evolved is very slight, and the loss inconsiderable, but the safest way is to dry over sulphuric acid. The presence of hydrocarbons in the graphitic residue, at once shows that this process could not be safely applied in the present case for the estimation of combined carbon directly. The following experiments illustrate the same point.

1. 1.42425 grms. iron dissolved in dilute sulphuric acid, and gases evolved passed over oxide of copper, gave 0.2525 gm. CO₂ = 0.4834 per cent carbon.
 2. 1.62425 gm. iron treated in the same manner gave 0.01625 gm. CO₂ = 0.2728 per cent carbon.
- The insoluble residues in both cases were collected and burned in oxygen.
- From 1 gave 0.1964 gm. CO₂ = 3.7612 + 0.4834 = 4.2446 per cent carbon.
- From 2 gave 0.2319 gm. CO₂ = 3.894 + 0.2728 = 4.1668 per cent carbon.

The deficiency in the amount of carbon in the gases in No 2 is made up by the larger quantity in the insoluble matter.

This method requires a large amount of time for its execution, the apparatus is somewhat complicated, and the great number of operations which the carbon must go through render the exercise of extreme care more than usually necessary.

I would here remark, that in all my experiments I found the perfect combustion of graphite, even in oxygen, required a very high temperature. In my first trials, I sought to burn graphite at a dull red heat in a tube of hard Bohemian glass, but it remained almost unaffected in a stream of oxygen. I found it most convenient to place the graphite first in a platinum boat, insert this into a well-glazed porcelain tube, and expose to a full red heat in a small charcoal furnace. In a gentle stream of oxygen the carbon is perfectly burned in a few minutes, and the resulting carbonic acid is absorbed in the usual way by potash solution.

(To be continued.)

* Ann. d. Chem. u. Pharm. xxx. p. 352.

† Ann. d. Chem. u. Pharm. xlii. p. 241.

‡ Chemical Gazette, vol. xi.

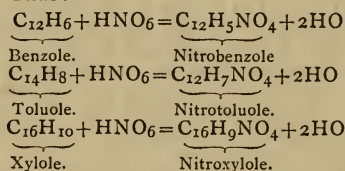
ON THE
UTILISATION OF THE WASTE PRODUCTS
OF THE MANUFACTURE OF COAL GAS.*

By DR. LETHEBY.

(Continued from page 56).

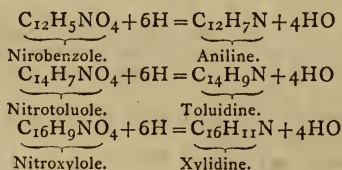
COAL-TAR COLOURS.

I will now make a few remarks on the processes which are followed for the production of coal-tar colours. Most of them are derived from the naphtha which is sold as 40 per cent benzole, which is a mixture of benzole and toluole with a little xylene. The first step of the process is to convert the constituents of this naphtha into the corresponding nitro-compounds, by carefully mixing it with fuming nitric acid or with a mixture of two parts of common nitric acid and one sulphuric. The reaction is very violent if the temperature is not controlled; but, with proper management, the three hydrocarbons lose each an equivalent of hydrogen to a like proportion of oxygen in the nitric acid, and gain the residual peroxide of nitrogen. Thus:—



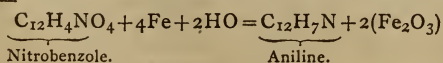
These three nitro-compounds constitute the dark amber-coloured, oily liquid which floats upon the acid; and when it is separated from the acid and washed with water, and then with a weak solution of carbonate of soda, it constitutes the crude nitrobenzole which is used for the manufacture of aniline colours.

It has a strong odour of bitter almonds, is heavier than water, and is very soluble in alcohol and ether. If this crude nitrobenzole be submitted to the action of a reducing agent, each of the nitro-compounds will lose its four equivalents of oxygen, and gain two of hydrogen, and be thereby converted into a corresponding alkaloid, thus:—



This process of reduction may be effected by sulphide of ammonium (Zinin's method), or by the nascent hydrogen evolved when zinc is treated with dilute sulphuric acid (Hofmann's method), or by acting on the nitro-compounds with iron and acetic acid (Bechamps' process). I show you here an experimental illustration of each of these processes, and you will observe that for lecture experiment the process of Hofmann is the most striking, but in practice the method of Bechamps is the most economical.

One hundred parts of the crude nitrobenzole is mixed with nearly its own weight of strong acetic acid, and to this is added little by little about 150 parts of iron turnings. The mixture is generally made in an iron retort, and after being well stirred it becomes hot, and soon forms a pasty mass of oxide of iron with an acetate of aniline and the other bases. The reactions are somewhat intricate, but they may be practically expressed thus—



And the same for the other nitro-compounds, so that theoretically the acetic acid should act indefinitely.

The mixture is then submitted to heat until the retort is nearly red hot, by which means impure aniline, &c., distils over, and when this is treated with a slight excess of lime or soda, and again distilled, it yields the crude aniline of commerce. The best product is obtained when the distillation is going on between the temperatures of 340° and 380°, for as the temperature rises to 626° two new alkaloids are produced, which Hofmann has named *paraniline* ($\text{C}_{24}\text{H}_{14}\text{N}_2$) and *xetylamine* ($\text{C}_{24}\text{H}_{11}\text{N}$).

Other processes have been suggested for the production of aniline and its homologues from the nitro-compounds; thus Kremer has recommended the use of finely powdered zinc; Wöhler, an alkaline solution of arsenious acid; Wagner, the ammoniacal solution of suboxide of copper; and Vohl, an alkaline solution of grape sugar; but none of these methods have taken the place of Bechamps.

The crude aniline of commerce, which is a mixture of aniline and toluidine, is more or less deeply coloured liquid of an amber tint; it is heavier than water, and it acquires a blue or red colour by various oxidizing agents. A solution of chloride of lime turns it, as we see, of a bluish-purple colour. It was this reaction which suggested the name of *kyanol*—blue oil. Acidulated with a mixture of equal parts of water and strong sulphuric acid, and treated with peroxide of manganese or peroxide of lead, it produces, as you observe, a rich blue. Chromic acid makes it, as you may see, of a green, a blue, or a black colour, according to the degree of oxidation; but the most remarkable experiment of all is the coloration of the aniline when it is acidulated with dilute sulphuric acid and submitted to the action of the galvanic battery. At the platinum pole, where oxygen is evolved, it instantly becomes bronze-green, then blue, then violet, and finally red; showing that the coloration of the alkaloid is due to the nascent oxygen, and that the tint corresponds to the degree of oxidation.

The crude aniline dissolves to some extent in water, but it is more freely soluble in alcohol and ether. It readily combines with acids, and forms crystalline compounds; hence it was called *crystalline* by Unverdorben, its discoverer. These salts become coloured on exposure to the air.

The production of colours from this liquid was the remarkable feature of the Exhibition of 1862. It dates from the year 1856, when Mr. Perkin discovered and patented the process for making a rich violet from aniline by means of bichromate of potash; but it is right to say that several chemists had long before noticed the fact that the salts of aniline were capable of producing rich colours. Runge, in 1835, obtained a violet blue by acting on one of the oily constituents of coal tar with chloride of lime. Five years afterwards Fritzsche observed the blue coloration of aniline with chromic acid, and the like thing was described by Beisenhirtz; but none of these reactions commanded attention until the year 1859, when Messrs. Guinon, Marnas, and Bonnet, of Lyons, introduced a new fast purple under the name of *French purple*, which they obtained from orchil, and which became a favourite and fashionable colour. The *mauve* of Mr. Perkin, which had been for three years before the public, was so much like it, that it rose suddenly into public favour. The year after, in 1859, M. Verguin, of the firm of Rénaud Brothers, of Lyons, obtained a brilliant red from the same base, and it was patented by them under the name of *fuchsine*. These two results commanded so much attention that the scientific and technical world entered very earnestly into the investigation with the view of discovering new processes of manufacture; and at the present time we have the means of making almost every variety of tint from coal-tar products. Most of these dyes are called aniline colours, but in truth they are produced from toluidine as well as aniline, and, as we shall see hereafter, they are obtained by processes of oxidation and substitution. They are generally classified under the heads of violets, reds, blues, greens, blacks, yellows, &c.

Violets.

These have received a variety of fanciful names, as *mauve*, *violine*, *rosolane*, *tyraline*, *indisine*, *harmaline*, *imperial violet*, *regina purple*, &c., &c.

The first of them was obtained in 1856 by Mr. Perkin, whose patent is dated the 26th of August of that year. His process is to add equivalent proportions of diluted solutions of a salt of aniline (generally the sulphate) and bichromate of potash. A good proportion is 2 parts by weight of aniline, 2 of bichromate of potash, and 1 of sulphuric acid of English commerce. The aniline and sulphuric acid are first mixed and then dissolved in water. To this solution is added the bichromate of potash, also previously dissolved in water, and after being well stirred they are allowed to remain quiet for 10 or 12 hours, when a dark-coloured sediment appears. This is to be collected upon a filter and well washed with cold water. It is then dried and treated with colourless coal-tar naphtha until all brown tarry and resinous matter is dissolved away. After this it is again dried and boiled in successive portions of alcohol or methylated spirit until the whole of the violet colouring matter is dissolved out. The spirit solutions are then distilled in order that the spirit may be recovered, and the residue is *mauve*. It amounts to only about 4 or 5 per cent in weight of the aniline used, but its tinctorial power is very great. In this condition it is not absolutely pure, although it is sufficiently so for common purposes. To purify it, it must be boiled in a large quantity of water, and the solution treated with an alkali. The colouring matter which precipitates is to be collected upon a filter, washed with water until all trace of alkali is removed, and then dissolved in spirit. If the spirituous solution be evaporated to dryness, the pure colouring matter remains as a beautiful bronze-like substance. It is hardly at all soluble in water, ether, or coal-tar naphtha; but it freely dissolves in spirit and in weak acids, especially acetic. Concentrated sulphuric acid dissolves it without decomposing it, and forms a dirty green solution, which becomes of a beautiful blue colour with a little water, and a violet or purple with a good deal. It is, therefore, a very permanent body, although it will not resist the action of chlorine or nitric acid. Reducing agents, as sulphide of ammonium or protosulphate of iron, change it to a brown-coloured solution, which re-acquires its violet tint on exposure to the air. Like most of the aniline dyes it forms a very insoluble coloured precipitate with tannin.

Other processes have been patented for making this colour; thus, Bolley, in 1858, Beale and Kirkham, in 1859, and Depouilly and Lauth, in 1860, patented the use of chloride of lime with a salt of aniline. These solutions, when used in proper proportions, produce an insoluble purple precipitate, which is the *mauve* of Perkin. It is purified by washing it with water slightly acidulated with sulphuric acid, then dissolving it in concentrated sulphuric acid, reprecipitating with water, washing it with water upon a filter, and lastly dissolving in spirit. In 1859 Mr. Kay patented a process for obtaining it by adding peroxide of manganese to a strong solution of sulphate of aniline, and keeping the mixture for some hours at the temperature of boiling water. The purple solution thus obtained is to be filtered and precipitated by adding ammonia until the acid is neutralised, and the precipitate, when collected upon a filter, washed with water, and then dissolved in spirit, forms the violet-coloured dye called *harmaline*. In the same year Mr. D. Price produced a patent for manufacturing the colour by means of peroxide of lead instead of peroxide of manganese, and Mr. Greville Williams obtained a patent for permanganate of potash. The year after (1860), there were several patents for it, as Mr. Stark's, with ferricyanide of potassium, and Messrs. Dale and Caro's, with perchloride of copper and chloride of sodium.

In the year 1861, Mr. Adam Girard observed that a purple colour could be obtained from aniline red by mixing it with its own weight of aniline and exposing it for several

hours to a temperature of 350° Fahr., which is a little short of the boiling-point of aniline. The mixtures employed were equal parts of dry muriate of rosaniline and aniline, and the product, which is a reduced condition of aniline red, is washed with water slightly acidulated with muriatic acid until all the unacted on aniline and aniline red are removed, and the pure purple remains. This is dissolved in spirit or acetic acid, and forms the dye called *Imperial purple*. In the year following (1862), Mr. Nicholson obtained his patent for procuring the same colour by merely heating Magenta or aniline red to a temperature of from 390° to 420° Fahr. The substance first melts, and, after evolving ammonia, is changed into the purple which he named *Regina purple*.

(To be continued.)

NOTE ON THE CRYSTALLISATION AND THE SOLUBILITY OF PLUMBIC CHLORIDE.

By J. CARTER BELL, F.C.S.

THE various manuals and dictionaries of chemistry, when speaking of plumbic chloride, fail to say anything on the phenomenon of its crystallisation; it is generally written that "it crystallises in brilliant needles." This state of crystallisation only occurs under certain conditions, for if pure plumbic chloride be taken and dissolved in boiling distilled water, and then allowed to cool, the chloride does not crystallise out "in brilliant needles," but in a sort of cuneiform or arrow-shaped crystals, which are not white but of a delicate cream colour, and in the many experiments I have performed, I have failed in producing white brilliant needles by this method. But if the solution contains free hydrochloric acid, then we obtain white needle-shaped crystals; and according to the amount of HCl present in the mother liquor, so will the crystals vary in size, colour, and shape. With a small per-centage of HCl, the crystals are white, and from 10 to 20 millimètres in length; if the HCl increases, very small white needles are obtained, and if it is strong HCl of 1.116 specific gravity, the crystals are no longer needle-shaped, but are of the form of the base of the right rhombic prism.

The Solubility of Plumbic Chloride.—A pure saturated solution of plumbic chloride at 16.5° Centigrade, contains .9414 per cent of the chloride, being the mean of three experiments; the addition of HCl diminishes the solubility considerably, and up to a certain point, which I have not yet determined, it may be stated that as the HCl increases the solubility decreases.

Water containing 1 per cent of HCl (sp. gr. 1.116) at 16.5°C. only holds in solution						Per-centage of PbCl ₂
"	"	2	"	"	"	.3470
"	"	3	"	"	"	.2013
"	"	4	"	"	"	.1656
"	"	5	"	"	"	.1459
"	"	6	"	"	"	.1310
"	"	7	"	"	"	.1078
"	"	8	"	"	"	.1007
"	"	9	"	"	"	.0991
"	"	10	"	"	"	.0968
"	"		"	"	"	.0931

A saturated solution of plumbic chloride in hydrochloric acid of specific gravity 1.116 at 16.5°C., contains 2.566 per cent of PbCl₂, but on the addition of water nearly the whole of the chloride is precipitated. These experiments seem to point that there must be a minimum hydrochloric solution of plumbic chloride, and also a maximum. Future experiments which I shall make will perhaps decide.

Manchester, July 29, 1867.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, AUG 6, 1867.

Meeting of the Society of Encouragement.—Writing inks.—Decoration of porcelain.—Steam machinery.—Industry of caoutchouc.—Reaction of oxygen on molten iron.—Researches on ozone.—Newton and Pascal.

THE Council of the Society of Encouragement held its periodical meeting in Paris on the 26th ult.; M. Dumas in the chair. MM. Robert and Theurer, watch and clock makers at Chaux-de-Fonds (Switzerland), laid before the society the drawings of their great repeating clockwork and winding apparatus for clocks and watches, an appendix to the communication made by them on the 12th July.

M. Becker, Rue-de-la-Glacière, 72, Paris, offered himself as a candidate for the prize founded by M. Alexandre for the improvement of writing inks, and handed in samples of his black and violet inks.

M. Besson, ceramic lithographer, made, in his name and that of M. Macé, porcelain manufacturer, a communication on the application of chromolithography to the decoration of porcelain. He showed how easy it was to transfer on porcelain and earthenware chromolithographic pictures executed on paper with the colours and varnish adapted for painting on porcelain.

M. Duprez explained a contrivance, invented by him, for a more perfect distribution of steam by a variable detent acting without the aid of an excentric. In all slide valves with a single box, according to the extent of the admission, the opening of the port is more and more narrowed, and the exhaust ports are opened sooner. M. Duprez, avoids this inconvenience by the following means, the employment of which is particularly adapted for locomotives. The contrivance consists in a parallelogram fixed to the crosshead. In the model presented to the Society, the durations of the admission and the compression are sensibly the same (at equal detents), as with the much employed system of the link valve reversed; but the new system gives the ports a greater opening by 45 per cent. An analogous combination, admitting a toothed wheel forming an epicycloidal, gives similar results, and is peculiarly adapted to stationary engines.

Mr. Balard placed before the Society the progress of the industry of caoutchouc during the last few years. Commerce has furnished, in fact, 9,000 tons of caoutchouc, the value of which is 40,000,000 francs in a raw state, and 75 to 80,000,000 francs in a manufactured state. One half of this quantity, and the purest, has come from the province of Para. The industrial demands are so important, that experiments have been made in Brazil for cultivating the tree which produces this substance, in the same way as the quinquina has been grown in the Himalaya. It is extensively used for waterproof clothing, boot soles, cards for wool, &c.; in the cards where much suppleness is required, the purest material from Para alone is used. The processes of vulcanising have also been perfected. The employment, for this purpose, of the chloride of sulphur, has become general; it has been employed either alone or dissolved in sulphide of carbon; the employment of litharge for neutralising the hydrochloric acid or moderating the sulphuration, has been better regulated. The temperature of 135°C., at which the vulcanisation takes place, has been rendered more fixed and certain by substituting, for the ordinary boiler, currents of steam. Cords of vulcanised caoutchouc are made of the pure materials, masticated with extreme care in small masses, which are kneaded together so as to form a homogeneous mass, the vulcanisation being effected by steeping the packets in water heated to a constant temperature of 135°C.

M. Troost, Professor of Chemistry, called the attention of the Society to the results obtained by properly treating cast iron at a high temperature with a current of oxygen gas. This experiment, made in 1855, by M. Henry

Saint-Claire Deville, is the starting point of all the researches subsequently made. It gives the means of easily obtaining Bessemer steel, or, if it be required, a very pure soft iron. M. Troost repeated his experiments before the assembly. The cast-iron, placed in a crucible of quicklime, is fused by the combustion of a mixture of hydrogen and oxygen gases. In this state, and by increasing the emission of oxygen, the carbon, silicium, and sulphur are burnt up, and form a dross which is absorbed by the substance of the crucible; the oxygen burns the iron itself, leaving the iron in a melted state, excellently pure.

From experiments carefully made, the hydrometric commission of Lyons has established since 1852 the habitual absence of ozone in the air of that town, while its presence is constantly evident in the exterior of the city. In the month of September, 1865, the Imperial Observatory caused the same studies to be made, on an extensive scale, over all France, with a view of discovering some law, if there is one, that would explain this phenomenon. The same reagent papers were remitted to all the stations, so that they might be rigorously compared together. The observations were taken during a whole year; the results of this immense work will be, perhaps, soon known to the world. Meanwhile, M. Fournet gives the conclusion arrived at by his resumed observations at Lyons and the suburbs, with the co-operation of M. Lambert and Rassinier. While ozone was very abundant at Sauvage, on the heights of Tararæ, a range of hills separating the basins of the Loire and Rhone, traces were barely perceptible once or twice a month at Lyons. It is well known that it has been often maintained that the arrival of the cholera was coincident with the disappearance of ozone in the air. The example of Lyons does not agree well with this assertion; this city is not subject to cholera, and, at the same time, its atmosphere is always deprived of oxygen.

The revelations of M. Chasles with respect to Pascal are the great topic of the day, and we wait here with impatience the news of its reception from the English press. M. Chasles is far from having furnished his last observations, as he has only placed before the public a small portion of his treasures. He is in possession of other documents which prove that Pascal had discovered before Newton, and even taught Newton, the admirable fact of the decomposition or the dispersion of light; that he was the first to make the celebrated experiment of the prism, to observe and number the seven principal colours of the solar spectrum.

The glory, also, of the employment of the word "differential," or "differential calculus" to distinguish it from the "calculation of fluxions and fluents" of analytical algebra properly so called, escaped Newton, to fall upon his adopted father Pascal. Newton will not cease to be considered as a great man, but the public will cease perhaps to believe in his genius and his good faith, when it will be known that at his earliest career he was in possession, through Leibnitz, of printed and manuscript documents of Kepler; through Viviani he had the MSS. of Galileo; by Pascal, the MSS. of Descartes, even those which were brought from Sweden after his death; these latter were sunk in the Seine along with the boat which carried them, and fished up again at the old quay of the Louvre; also by Pascal, Newton had his letters, notes, thoughts on attraction, the decomposition of light, the differential method, &c. When he had such a remarkably precious store, it is not surprising that he arrived at such wonderful results, but it is astonishing that he took so long a time to put these documents in practical use. Ah! if Pascal had had the time and leisure necessary to write in French the *Principia*, with what depth and clearness would he have developed his magnificent theme!

M. Chasles possesses also a letter in which Arnaud, grieved a little at the effect produced by the first of the "Provincial Letters" wrote a most interesting word of encouragement to Pascal. F. MOIGNO.

REPORTS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

A COURSE OF FOUR LECTURES ON

SPECTRUM ANALYSIS,

WITH ITS APPLICATIONS TO ASTRONOMY.

By WILLIAM ALLEN MILLER, M.D., F.R.S., &c.

LECTURE IV.

(Concluded from page 49).

Spectra of the Fixed Stars.—Mode of observation.—Double Stars.—Variable Stars.—Temporary Bright Star in Corona.—Nebulæ.—Clouds.—General Conclusions.

A great number of other stars have been examined. I cannot, however, attempt to give you any idea of their composition in detail, but must refer you to a list which you will see here, giving the names of the more important stars, which we have examined more or less completely. Among the most interesting of the stars we have examined are Sirius, Arcturus, Capella, Vega, Pollux, Castor, Cygni, Procyon, and α and γ Andromedæ, Rigel, Spica Virginis, α Aquilæ, Cor Caroli, Regulus, and others. The general result of these investigations shows that the stars are bodies, formed upon the same plan as our sun, each differing in composition from its fellows, but all apparently containing matter, some portion of which is identical with that composing a part of our own globe.

One or two of these stars may be advantageously referred to more fully. Among these, a red star β Pegasi is much like the star α Orionis in its general character, but it is much fainter. It is one of the third magnitude. Here we have been able to measure only twenty lines. We can see that it is full of lines, but the uncertainty of the atmosphere and the difficulty of seeing these lines with precision have prevented us from accurately fixing the places of a larger number. It contains sodium and magnesium—two of the same bodies which are present in Aldebaran; and, besides that, it is probable, though we have not been able to verify all the principal lines, that barium, iron, and manganese are present.

Let me now call your attention to the colours which the stars exhibit. It is a matter of familiar observation that the stars differ in their tint. This difference appears to be caused in many cases by the atmosphere outside the photosphere, which causes an absorption of certain colours contained in their light, and in consequence of this we have a difference in the tint. It is remarkable that in some of the red or orange stars, like β Pegasi, and others, hydrogen is absent, whilst in the white stars this element is predominant. In the spectrum of the important star called Vega (α Lyræ), sodium, hydrogen, and iron have been found. It might be supposed that the star Sirius, the brightest of all the stars, would have given us more information than all the others; but it is not so. I will throw its spectrum upon the screen, and you will see that it is remarkable for the absence of strong lines. The light of Sirius is white. There are only three important lines in its spectrum, and these correspond exactly in position with the lines of hydrogen. With these exceptions, the lines of Sirius are feeble. I do not mean to say that there are not other bodies in the stars besides hydrogen, but the proportion of those other bodies must be so small, and the vapour so dilute, that the whiteness of the light is not subdued by them in any remarkable degree. Here are lines which correspond to F and C; here is a line in the blue; and here is one which we constantly find in all the stars, the double sodium line D. Here is the magnesium line; and here is one which is probably due to iron.

Let me now call your attention to the varieties in colour which the stars exhibit. Sirius, as I have said, is a white star. There are stars which have an orange, or

yellow, or ruddy tint; and, again, there are others which are blue, or green, or purple.

The examination of these coloured stars is often a matter of great difficulty, because in general their luminosity is small, and frequently these coloured stars occur in pairs, constituting what are known as double stars. It often happens that a bright orange-coloured star has a faint blue or green star as its companion; and this companion is often so close that it is a matter of considerable difficulty to separate the spectra of the two stars, though we can see them in the telescope distinctly enough. In order to separate the spectra of two stars it is needful so to arrange the motions of the telescope that the spectra shall be always at right angles to the line joining the two stars, so as to maintain the two spectra parallel to prevent them from overlapping, and so interfering with one another. I will take first an orange-coloured star, the brighter of the double stars which constitute Hercules; in the spectrum of this star on the screen, you will see the orange and yellow predominating, whilst other portions of the light are subdued in consequence of the presence of a large quantity of absorbent matter, which stops certain rays in the blue and violet portions of the spectrum. You must bear in mind that in throwing these images upon the screen we are under a considerable disadvantage, because though they are tinted to give you an idea of the relative position which these lines occupy in the spectrum, they do not by any means represent with accuracy the colours which the star itself would show. You will see in the red part of the spectrum there are three or four strong lines, but in the orange and yellow there are comparatively few, so that this star shines with an orange light in consequence of the absorption of the green and blue portions.

I will now take one of the double stars, β Cygni, and project an image of the orange star, with its blue companion, on the screen. The orange star is the more brilliant one. The blue star is so faint upon the screen that you can hardly see it from a distance. You may imagine from this what is the difficulty in seeing, and still more in measuring the position of such faint lines as these. Let us now examine the spectra of the two stars. That of the orange star is characterised by a large number of bands or lines in the blue and green portions, and comparatively few in the yellow portions. In the spectrum of the blue star we have scarcely any lines in the blue, but a large number of lines in the yellow and orange, and in some parts of the red.

We have here, then, examined two classes of stars—some which have a considerable brilliancy, and others in which we have them varying in colour; but there are other variations in the stars, respecting which the spectroscopist, we may hope, will at some time or other afford information. Some of the most remarkable amongst the stars are variable in their lustre. At times they shine out with a high brilliancy, and at others they become reduced and almost disappear from view. One of the most interesting problems demanding solution in the nature of stellar bodies, is the explanation of this singular periodical variation. Sometimes these periods are tolerably regular, occurring after a few days, or a few months, or sometimes after years. At other times the periodical variations in the star are irregular; that is to say, though the light of the star waxes and wanes in intensity, it does so at irregular intervals. One single observation seems to show, so far as it goes, that there is hope of further progress in this direction. The star α Orionis, one of the first whose spectra I projected on the screen, is a variable star. It is one, however, of which the variation is not very wide. It varies, perhaps, half a degree in magnitude. We found, on making observations when it was at its maximum, that a certain group of lines which were observed two years before, when it was at a low state of illumination, had disappeared. Their position had been carefully measured during a period of minimum, but these lines were not found when the star was at its maximum.

There are, however, others falling under this class of variable stars which are still more remarkable. They have been called temporary stars. One of the most prominent of these was noticed on November 7, 1572, when Tycho Brahé, in returning one evening from his observatory, saw persons gazing at a star which he knew was not visible half-an-hour before. It continued to increase in brightness for some weeks, but in the course of a year it gradually dwindled away. This star has been altogether lost sight of, and no one knows its true position. In October, 1604, a star equally bright appeared in Serpentarius. It almost rivalled Jupiter in brightness. It afterwards faded away and disappeared. In the year 1848 Mr. Hind observed a smaller star, in Ophiuchus, of a ruddy colour, which came out and disappeared in the same sort of way. Lately we have had an opportunity of watching one of these stars, which has thus blazed out, and rapidly died away. It was even more brief in its blazing forth, and more rapid in its disappearance, than any of the others; but, happily, at the moment the opportunity offered, we were prepared to examine its light by means of the spectroscope. Mr. Birmingham, of Tuam, first saw it in Ireland, on the 12th May, 1866. He informed my friend Mr. Huggins, who received the news of its presence on the 16th May, and by the same post, Mr. Baxendell, of Liverpool, directed his attention to the star. No time was lost. On the very same evening on which the intelligence arrived, as it happened to be a fine night, we directed the telescope to the spot, and we were able to discover a most remarkable state of things. I shall project on the screen the image of this star. It blazed forth in Corona. About the time Mr. Birmingham saw it it was of the second magnitude. It occupied the position of a star of the ninth or tenth magnitude noted by Argelander. You will observe that the spectrum of this star is crossed as usual by a number of black lines in the luminous coloured portions; but, besides that, you will see some very bright bands of light—four strong lines, and a fifth much fainter in the blue. We had never seen such lines in any solar or stellar observation before, and they are evidently connected with a new, and, as it turned out, a transient state of things. Two of these lines occupied the position of the lines of hydrogen. One corresponding to the line C in the solar spectrum, and another to the line F. There are two strong brilliant lines in the blue, the nature of which we were not able to ascertain. The duration of the outburst till it dwindled down to a star of the seventh or eighth magnitude, was but a week, so that the opportunities of making observations and measurements were but few. In this star, then, we have three different spectra. First, we have a photosphere giving out a continuous spectrum, and over that we have the usual state of the solar and stellar atmospheres—that is to say, an atmosphere filled with luminous vapours, capable of absorbing a part of the light behind; and then, outside that, more brilliant still, is a luminous spectrum of glowing gas, as though this star was suddenly involved in the flames of hydrogen, combining with some substance the nature of which we do not know, but which may be—probably is—connected with the two unexplained brilliant lines in the blue. I say this star, at the time of this outburst of light, was in a condition in which a sudden and violent action upon the hydrogen occurred, in consequence of which, probably, the whole mass of the star was raised in temperature, and its luminosity consequently was increased, but the temperature of the mass of the star was not brought up to the same point as the temperature of the hydrogen by which that incandescence appears to have been produced. What the origin of this hydrogen was of course it would be vain and idle to speculate, but the presence of hydrogen is certainly revealed by the observations just described. Moreover, the hydrogen must have been in a state of active incandescence which may be supposed to be the cause of the humidity of the star, and just as a glowing ball of lime is heated up in the nearly lightless flame of the oxyhydrogen jet, so the nucleus of this star was lighted up by an outburst of

hydrogen suddenly brought to an intensely incandescent condition. It is clear that this observation could not have been made without the aid of the spectroscope, for on viewing a star through the telescope all that can be seen is limited to variations of colour and brilliancy; we can never magnify a star so as to produce anything more than a point of light. We can never get a disc. We have simply an increase in the intensity of the light as we increase our telescopic power. Among the most remarkable of the variable stars is η Argus, the spectrum of which seems to demand a careful study.

I must now pass on to a totally different series of objects—the *nebulae*. Scattered over different parts of the heavens are a number of remarkable bodies which look like patches of light or luminous clouds. In some cases they are collected into rings; in others into spirals, whilst in other instances they assume still more definite forms. These nebulous masses of light have ever since their discovery excited in a high degree the wonder and curiosity of those who have examined them. The interest they awaken is perhaps still further increased by a remarkable speculation concerning them put forth by Sir William Herschel, when asked whether it was not possible that these nebulae might be the primordial forms of matter from which stars and suns and their attendant planets had been produced. Notwithstanding minute and careful observations by the telescope nothing was known of the physical condition of the matter comprising these nebulae. It was not even known whether they were aggregations of stars so infinitely distant from us that we could not discern the separate stars, or whether each nebula was a separate luminous object of a nature entirely different from the stars. Mr. Huggins has been enabled in several instances to show that the nebulae are not stars, but that they are composed of glowing gas; and, farther than that, he has been enabled to give some hint as to what this gas may be. I must now ask you to look at the photographs of some of these bodies, which I shall throw upon the screen; many of them have been taken from the beautiful drawings of Lord Rosse. When Mr. Huggins was examining one of these nebulae with his spectroscope for the first time, he observed what appeared to be a single vertical line of light, this on closer inspection was seen to be accompanied by two fainter lines in the more refrangible portion. This observation immediately gave him the key to the nature of these bodies. The first nebulae that he examined was a comparatively brilliant one in Draco (37 H iv.). The nebulae are usually referred to by letters and numbers, which represent the position of these bodies in certain catalogues drawn up by astronomers of eminence. This nebula in Draco, then, instead of giving a continuous spectrum, crossed by black lines like the stars, was found to give three lines of light only, and the greater part of the light was concentrated into one of these three lines. Indeed, had it not been for this circumstance, the light of the nebula is so excessively faint that it would have been impossible to see it at all as spread out in a continuous spectrum, and, in fact, my friend scarcely expected that it would be possible to get any accurate observation in consequence of the faintness of the light. The result, however, amply rewarded him for his trial. You observe upon the screen a spectrum consisting of three lines only. They are here exaggerated very greatly in brilliancy, for the purpose of rendering them visible at all. Below the representation of the spectrum of the nebula on the diagram are the bright lines which correspond most nearly with its lines. This line F corresponds exactly with the faintest of the three lines in the nebula. It is very difficult in diagrams of this kind to preserve the true relation in brilliancy of these lines to each other. At the less refrangible end there is no line corresponding to the red line of hydrogen. An important observation made by Plücker upon rarefied gases in tubes may have a bearing on this point. He found that as hydrogen becomes rarefied, its red line disappears. Hence the absence of the red hydrogen line in the nebula may be connected with the attenu-

ated condition of its gaseous materials. In the diagram you will see three other lines occurring in the solar spectrum. Those are lines which correspond to the group of magnesium lines. The brightest and most refrangible line in the spectrum of the nebula corresponds to one of the brightest lines of nitrogen. It is remarkable, however, that the other lines of nitrogen are absent. This second line in the nebular spectrum does not correspond to any of the lines that are known to us, but the newest known to it is one of the lines of barium. It must not be supposed that all the nebulae are exactly like this one. Of the sixty which Mr. Huggins has examined, about twenty exhibit the bright lines due to matter in its gaseous state, all of which contain the bright line corresponding to that of nitrogen; in some the other fainter lines are not seen. Such spectra, therefore, are not produced by a group of stars; not by a substance like any others that we have seen hitherto in the heavens; they must be furnished by masses of glowing gas, which are giving out light of these three particular degrees of refrangibility.

Besides these true gaseous nebulae there are a vast number of others, but in some of them the luminous material is connected in such a way that they appear in the telescope like clusters of minute stars, or they look as if condensed into little points of greater luminosity than others. Now, when such clusters are examined by the spectroscope they are found to furnish continuous spectra crossed in some cases by the same light lines produced by the nebulae which are wholly gaseous, so that here the nebulae appear to consist of two portions, one still gaseous, the other undergoing a sort of condensation. One dares hardly to speculate upon these matters in the present state of our knowledge. It is so easy to speculate and get wrong, and thus to fix notions in one's mind that it is not easy to get rid of again. The truly philosophical course here is simply to form such a hypothesis upon the facts observed as shall serve to guide us in our further investigations.

My friend, Mr. Huggins, has placed a large number of his beautiful drawings of nebulous bodies at my disposal. I can only select one or two for exhibition on the screen. There is a nebula which has a remarkable shape like that of the planet Saturn. All these nebulae have a particular faint bluish green light. Here there are the same three lines. Here, again, is a remarkable spiral nebula (80 H iv.), which has been very carefully observed by Lord Rosse. You will see the style and character of its construction. But it is also remarkable for its brightness in comparison with some of the others. Besides the three lines previously noted we observe a further bright line which is more refrangible than the others. The gaseous character of this nebula is distinctly seen. I will now take a nebula which is not gaseous, and which is visible to the naked eye—the well-known nebula in Andromeda. There is a concentration of light in its nucleus around which is expanded into a longitudinal form. It does not give a spectrum with bright lines, but a continuous spectrum with certain peculiarities. The orange and red portions are almost absent, and the other portion has a mottled appearance, which it is scarcely possible adequately to represent upon the screen. Here is a table which will give you an idea of the character of the nebulae examined by Mr. Huggins, and the results of his observations compared with the purely telescopic observations of Lord Rosse, as furnished to Mr. Huggins by Lord Oxmantown:—

	Continuous spectrum.	Gaseous spectrum.
Clusters	10 ..	0
Resolved or Resolved ? ..	5 ..	0
Resolvable or Resolvable ? ..	10 ..	6
Blue or green, no resolvability, no resolvability seen }	0 ..	4
	6 ..	5
	—	—
	31 ..	15
Not observed by Lord Rosse	10 ..	4
	— 41	— 19

Here are the results which were arrived at by Lord Rosse by observation with his colossal reflecting telescope. First of all are ten clusters, and amongst these clusters all give a continuous spectrum. None of them appear in the spectroscope to have a gaseous spectrum, so that the observations of the telescope and spectroscope correspond. The second line represents to us a certain class of bodies which, though they have not actually been resolved into separate stars as the others have been, yet appear to be resolved. None of the bodies exhibit gaseous spectra. On the other hand, amongst those which have a blue or green colour there are none which are not gaseous. Then there is a group which are not resolvable, some of which give a continuous spectrum and others a gaseous spectrum.

I have thus endeavoured, however imperfectly I have succeeded, but still so far as time and opportunity admitted, to bring before you some of these spectrum discoveries. The more we pursue studies of this matter the more is the mind carried forward with the desire for further knowledge. Whilst thus from time to time we are permitted to get fresh glimpses into the constitution of the universe, and to trace something more of the infinite mind which has designed the whole, so should we feel the more that we are bound to use the fresh knowledge thus placed at our disposal, not for the glory of man, but, as far as may be, for the glorifying Him who made all things and upholds all things by the word of His power.

ACADEMY OF SCIENCES.

JULY 29, 1867.

(FROM OUR OWN CORRESPONDENT.)

Pascal's letters forgeries.—Rain fall in Alsatia.—Experiments on Induction currents.—Surgical instruments from Pompeii.

THE Abbé Zantadeschi presented a copy of a work on the climate of Catania, the conclusions of which are that this country is one of the spots in Italy where the climate is most mild, and it is exactly the place where persons suffering from pulmonary complaints should be sent.

M. Faugère, sub-director of the Minister of Foreign Affairs, who had devoted his life to the subjects of the illustrious Pascal, and the history of his family, who had the good fortune to discover the several precious unpublished documents entitled "*Pensées, fragments et lettres de Blaise Pascal*," was struck with the account of the letters and notes presented and given to the Academy by M. Chasles; he wished to see these surprising autographs, and was convinced that the signature of the letters deposited by M. Chasles is not that of Pascal, but that they are simply forgeries. He requested the Academy to appoint a commission for as scrupulously as possible inquiring into the authenticity of these documents.

M. Chasles replied that he had no doubt whatever on the validity of the letters and notes presented by him, and that he hailed with pleasure the appointment of the commission demanded by M. Faugère. The members are MM. Chevreuil, president; Delaunay, V.P.; Elie de Beaumont and Coste, secretaries; Chasles, Duamel, Pouillet, Faye and Leverrier. M. Chasles disputed the assertion of M. Duamel, "In admitting the authenticity of the letters deposited by M. Chasles, and supposing even that they had been published before the *Principia*, they would not give the right of priority to Pascal for the law of universal gravitation. The glory will ever rest with Newton." M. Chasles maintains, on the contrary, that the glory of the discovery, and the demonstration of universal attraction proportional to the masses is in the inverse ratio of the distance, belongs to the immortal Pascal. He proved by calling to mind the following of the letters and notes of the illustrious philosopher, and which will create a profound sensation in England.

M. Becquerel presented a note on the temperature of water currents, by M. Ch. Grad.

In two former communications he gave his researches on the fall of rain in Alsatia, and the relations which exist between the flow of water in the Ill, and the rainfall in its basin; to-day he submitted the result of the running waters in the same region. These observations, repeated twice a day, at 7 a.m. and 4 p.m. were made principally on the Fecht. The Fecht is a sort of torrential river, taking rise in the Hautes Vosges at a height of 3,300 feet above the level of the sea. The following are the comparisons made between the temperature of the water and that of the air:—The mean temperature of the water from July, 1866, to June, 1867, was found to be $10^{\circ}5$ C. inferior, by $0^{\circ}8$, that of the air at Turckheim. The difference between the temperature, maxima and minima, of the year was $23^{\circ}7$. The greatest variation was during the month of May, $13^{\circ}3$, and the greatest diurnal variation, $7^{\circ}6$, occurred the 14th July. The amplitude of the oscillations is less for water than for air; the temperature of water attains its diurnal maximum and minimum only after the maximum and minimum of the air have been reached. In summer the rains lessen the temperature of the Fecht, and in winter it is raised. Also the range of variations was found to be more decided in summer than in winter; weaker under an overcast sky than in a clear one, and it becomes more pronounced according as we recede from the sources, with the increase of volume of the water-course. This last observation confirms those of M. A. Bertin on the temperature of the Ill at Strasbourg, and the Lower Rhine at the Kehl Bridge, as shown by the following results:—During the year 1858 to 1859, the average temperature of the air at Strasbourg was $10^{\circ}2$ C.; that at Kehl Bridge $10^{\circ}5$; the water of the Rhine at Kehl Bridge, $10^{\circ}9$; the Ill at Strasbourg, $11^{\circ}2$. These results give to the Ill and the Rhine a higher temperature than that of the Fecht; and this general law can be deduced, that in the same region the temperature of running waters increases with their volume.

M. Regnault presented, in the name of M. Blaserna, professor of the University of Palermo, results of experiments on the passage of induction currents. His conclusions are the following:—1. The time elapsed between the closing or the rupture of the circuit and the apparition of the current of induction, or the attraction of the armature for the bobbin of induction is inappreciable, less than the fiftieth part of a second. 2. The current of induction, feeble at its commencement, increases little by little, then diminishes, and is extinguished in an interval difficult to determine.

M. Elie de Beaumont gave official notice of the election of M. Wurtz in place of M. Pelouze, late master of the Paris Mint, and called upon him to take his chair.

Dr. Scoutteten, principal physician of the army of France, read a paper on the surgical instruments, probes, specula, &c., found in the ruins of Pompeii. He mentioned, especially, one instrument, a probe, presented by Gallien to a magistrate named Erastistrate, and which seems preferable, in a practical point of view, to those now in use.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

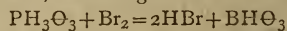
Influence of a Current of Gas on the Decomposition of Compounds.—D. Gernez. When a current of an indifferent gas, as nitrogen, hydrogen, or air, passes through a solution of baric, calcic, or potassic bicarbonate, carbonic acid is given off; alcale sulphhydrates under these conditions lose sulphuretted hydrogen, and acid sulphites and acetates are converted into neutral salts. These phenomena of decomposition are considered due to dissociation.—(*Comptes R.* lxiv. 606.)

Thallium-amalgam.—J. Regnaud. Thallium combines with mercury with evolution of heat, and the amalgam is electro-negative compared with thallium; this is a

further proof of the fact that, whenever a metal dissolves in mercury and heat is given off, the metal is electro-positive in comparison with the amalgam.—(*Comptes R.* lxiv. 611.)

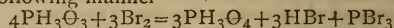
Propyle-benzol, Action of Bromine on.—E. Meusel. The action of bromine on cumol at ordinary temperature gives rise to the formation of two substitution-compounds, monobromcumol $C_9H_{11}Br$, boiling between 218° and 220° , and a crystalline compound of the composition $C_9H_7Br_5$, melting at 99° — 100° . At high temperatures and in presence of water an acid has been obtained which has the composition of dibrombenzoic acid.—(*Zeitschr. Chem.* N. F. iii. 322.)

Phosphorous Acid, Action of Bromine and Iodine on.—G. Gustavson. Equal molecules of bromine and phosphorous acid act upon each other in sealed tubes at 100° and below, according to the following equation

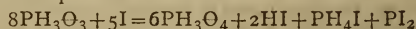


Metaphosphoric acid.

Four molecules of acid and three of bromine decompose in the following manner—



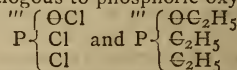
Iodine combines less readily with phosphorous acid; the reaction between eight molecules of the latter and five of iodine takes place as follows:—



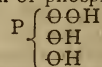
—(*Akad. Petersb.* xi. 299.)

Thallium.—Wöhler separates this metal from flue-dust in the following manner:—The material is repeatedly extracted with boiling water, slightly acidulated with sulphuric acid, and the filtrate, without previous concentration, precipitated with chlorhydric acid. The chloride is converted into sulphate, and the latter in aqueous solution reduced by zinc or by an electric current derived from a single cell: the metal is finally fused under a layer of potassic cyanide.*—(*Ann. Chem. Pharm.* cxlii. 263.)

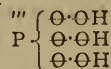
Phosphorus, Combinations of.—H. Wichelhaus. The compound $PCl_2(OBr)$ has been obtained (*Menschutkin Ann. Ch. Ph.* 139, 343), by acting upon absolute alcohol with phosphoric terchloride, and substituting in the compound $PCl_2(OEtH_5)$ thus formed, bromine for ethyle. The author has by means of this reaction, but employing chlorine instead of bromine, prepared the compound $PCl_2(OCl)$, which, he finds, is identical with the ordinary phosphoric oxychloride. This synthesis has some not unimportant consequences. It will be possible, starting from oxychloride or ethylephosphorous chloride, to prepare the compound $PO(EtH_5)_3$, which, supposing it to be identical with the oxide of triethylephosphine, will thus prove the constitution of the latter to be analogous to phosphoric oxychloride—



Further, the constitution of phosphoric acid will be



showing it to be the mono-oxy-acid of phosphorous acid, and the existence of di- and tri-oxy-acids consequently may be predicted. The author believes to have already obtained the compound



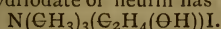
(*Zeitschr. Chem.* N. F. iii. 321.)

Neurin.—A. Baeyer. The constitution of neurin is that of the hydrate of trimethyle-oxethyle-ammonium

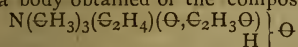
$$= N(EH_3)_3 \left\{ \begin{array}{c} (EtH_4(HO)) \\ H \end{array} \right\} \oplus$$

*This is identical with the process by which I prepared considerable quantities of thallium four years ago. For full details see *CHEMICAL NEWS*, vol. viii., p. 159.—W.C.

The auro-chloride of this base
 $= \text{N}\text{C}_5\text{H}_{14}\text{OCl}, \text{AuCl}_3$
 is soluble in hot water, and crystallises in beautiful yellow needles. The hydriodate of neurin has the formula



but if neurin is heated with an excess of hydriodic acid, water is eliminated, and the iodide $\text{N}(\text{C}_2\text{H}_5)_3(\text{C}_2\text{H}_4\text{I})$ formed which on being treated with argentic oxide yields a base, the auro-chloride of which has the composition $\text{N}\text{C}_5\text{H}_{12}\text{Cl}, \text{AuCl}_3$, showing thus a conversion of neurin into a vinylic compound. The platino-chloride contains one molecule of water. In order to remove any doubt as to the existence of oxethyle $= \text{C}_2\text{H}_4(\text{OH})$ in neurin, the action of acetylic chloride upon the latter had been tried, and a body obtained of the composition



which is neurin wherein an atom of hydrogen is replaced by acetylic.—(*Ann. Chem. Pharm.* cxlii. 322).

NOTICES OF BOOKS.

Gas Manipulation. By the late HENRY BANNISTER, Enlarged by WM. T. SUGG. London: Henry Sugg, 32, Henrietta Street, Covent Garden. 1867.

OUR most eminent chemical authorities have lately interested themselves so deeply, not only in the actual quality of coal-gas, but also in practical details whose consideration is necessary for understanding how impurities appear, persist and accumulate, that, as a result, gas manipulation has become a branch of study that may be called chemical jurisprudence. Thus, within a very few years, by laborious investigations of chemists, the subject of gas supply, with the impurities of gas, has been raised to a degree of accuracy equal or even superior to that of the sister subject of water supply, with its impurities. These two subjects, with histories so very different, have reached a nearly identical climax, in that the chemist and the engineer will for the future have nearly an equal weight of evidence to give in the witness box, on questions touching either subject. A branch of the science is thus steadily growing in importance, and we should welcome with much pleasure a short text-book on this department of chemical jurisprudence for the busy practical man.

Such a work would now, thanks to the enterprise of publishers, and the increasing number of text-books on all these subjects, be a mere matter of compilation, giving in one volume information of the most valuable character, now scattered in scores, or even hundreds of books and pamphlets, which matter, we have much reason to fear, will be quite lost to the profession if not properly secured in time.

In the absence of such a book, however, Bannister's, or rather Sugg's gas manipulation (so greatly has the original book been enlarged and improved), will for many years be a valuable text-book for the chemical jurist; this could not so justly be stated of the former edition.

With regard to some minor points, in fairness to our readers we must make a few remarks and extracts;—thus the use of turmeric paper for testing the presence of volatile alkali, is advocated without any mention of the fallacies that attend its use; the very great superiority of red litmus paper in this respect has generally been insisted upon, especially by Mr. Bowditch. Again, for the quantitative estimation of ammonia, the decimally divided imperial liquid measure is used, which, however good in its way, has not the sanction of extensive use by chemists. With an English and French method in vogue of nearly equally extensive use, there is no room even for "a golden mean" system, as its advocates would call it. In any estimates made in legal statements, a very simple question would become infinitely involved by the necessary explanation that one cubic

inch = $36 \cdot 06543$ septems, and that 1 litre = $2 \cdot 2$ decigallons. We think that by quoting one example, the volumetric testing by this method will be seen to be decidedly inferior to more recent methods.

"For testing ammonia by oxalic acid"—"the following solutions are required." 1. A solution of oxalic acid, 100 septems of which are equal to 10 grains of ammonia; 2. A solution of ammonia of which 100 septems contain 1 grain of ammonia. 3. Tincture of hematine; for this septem-burettes, &c., are used; the results thus obtained are not at all readily calculated either into grain or gramme measures.

In another part of the book, fluid ounces and drachms are used for volumetric purposes.

A valuable portion of the work is devoted to the question of photometry, which is most skilfully handled. Two full-page illustrations of the photometers of Bunsen and Dr. Letheby respectively are given in white lines on a black ground, and the doctrine of irradiation as connected with luminous impressions, is very markedly illustrated on a large scale by these beautifully clear prints. 15 other engravings are also given on toned paper, equally artistically executed; and we have no hesitation in saying that this is the most perfectly illustrated scientific work that we know of, published in England.

We leave to our readers the pleasure of reading the details of the self-registering photometer, by which with the aid of photometry the varying pressure of gas may be registered during the 24 hours,

It has been named after the workers out of the idea, Messrs. Kirkham and Sugg, who acknowledge the valuable assistance rendered by Mr. Glaisher.

To those of our readers who have studied Mr. Bowditch's experiments on the value of illuminating candles, which seemed of such a convincing nature, and have remembered Dr. Frankland's remarks on the same subject, the following extract from the preface will be of interest;

"The variations so frequently found to occur when using the standard candle in conducting experiments, are shown to be in a great measure attributable to a defective mode of application; and suggestions, based on actual practice, are offered, the adoption of which will ensure as great an approximation to the truest results as the present Parliamentary regulations will admit of."

CORRESPONDENCE.

PRESERVATION OF FOOD.

To the Editor of the Chemical News.

SIR,—In reference to our pamphlet upon the preservation of food, will you permit us to state that with the mass of evidence at our disposal we could readily have shown a long list of the so-called "preservative processes" which have proved utter failures, and could have conclusively exhibited the causes of their non-success, but such a course would have necessitated the mention of numbers, dates, and names, together with comparisons which might possibly have been considered invidious, and we preferred, while giving the public much general information relating to what has hitherto been attempted in meat preservation, to keep out of the treatise anything likely to be considered personal, or to give offence.

We beg to draw your attention to the sixth edition of the pamphlet, containing much new matter, and to remark that the practical success of Medlock and Bailey's new patent process, as evidenced by the results obtained by various well-known metropolitan butchers, meat-salesmen, fishmongers, &c., has been quite beyond our expectation for the short period that has elapsed. The Canadian experiments were conducted by Mr. Collett, and those in this country, under the superintendence of Dr. Henry Medlock and Mr. Wentworth Scott.—We are, &c.,
 WILLIAM BAILEY AND SON.

REMARKS ON THE EARTH'S DENSITY.

To the Editor of the Chemical News.

SIR,—My attention has again been directed to the difference existing between the earth's density and the mean specific gravity of the minerals constituting its crust, by the following paragraph, occurring in a recent lecture by Mr. T. Sterry Hunt:—"We may suppose an arrangement of the condensed matters at the centre (of the earth) according to their respective specific gravities, and thus the fact that the density of the earth as a whole is about twice the mean density of the matters which form its solid surface."

On the same subject, W. R. Grove, Esq., in his address to the British Association, 1866, makes the following remarks:—"Surprise has often been expressed that while the mean specific gravity of the globe is from five to six times that of water, the mean specific gravity of the crust is barely half as great. It has long seemed to me that there is no ground for wonder here. The exterior of our planet is to a considerable depth oxidized; the interior is in all probability free from oxygen, and whatever bodies exist there, are in a reduced or deoxidized state; if so, their specific gravity must be higher (?) than that of their oxides, chlorides, &c."

This theory of Mr. Grove, although plausible, is scarcely satisfactory, as it will be seen that many of the substances which go to form the great bulk of the earth's crust, are actually lower in specific gravity as metals than they are when oxidised; while others differ but little in density whether as metals or oxides. The metals whose densities are much lower than their oxides are the metals which form but a small proportion of the earth's crust, and the oxidation or deoxidation of which could make but a trifling difference in our earth's density. Any such difference would be more than counteracted by the opposite tendency of those substances which constitute the great bulk of the earth's crust, as shown in the following table:—

Metals	Sp. gr.	Oxides.	Sp. gr.
Silicon ..	2.49	Silica ..	2.66
Calcium ..	1.57	Lime ..	3.08
Magnesium ..	1.74	Magnesia ..	3.40
Aluminium ..	2.56	Alumina* ..	4.00
Sodium ..	0.97	Soda ..	2.00
Barium ..	1.50	Baryta ..	4.00
Potassium ..	0.86	Potassa ..	2.10
Strontium ..	2.50	Strontia ..	3.90

These examples prove that supposing the earth, beneath the crust to which we have access, to consist of the same metals as above, but in an unoxidised state, the density of the earth would actually be less than the specific gravity indicated by an average of the minerals existing on the surface. Unless, indeed, a far greater proportion of the heavier metals exist in the interior of the earth than on its surface. That the heavy metals do exist in much greater proportion towards the centre of the earth I think is undoubtedly the case, and the only means of solving the difficulty.

During the cooling down of the molten planet the heaviest metals would naturally tend towards the centre, and hence if we take a table of specific gravities of the metals, we find a singular relationship to exist between the density and scarcity of a metal.

Thus we find platinum and gold to stand almost at the head of the list in point of density and scarcity, while aluminium, calcium, magnesium, &c, stand conspicuous for their great abundance and for the lowness of their specific gravities. The metals mercury, zinc, lead, &c, may appear at first sight not to fit in with this supposed law, but when we take into account either their ready volatility or their avidity for sulphur or oxygen, as the case may be, their comparative abundance at the earth's surface may be explained notwith-

standing their high densities. For instance, mercury and zinc would be among the very last of the solid substances, volatilized by the earth's heat, to condense; and would in all probability come into contact with large quantities of sulphur vapour, and would naturally take that form in which we find these metals most abundantly.

Another exceptional circumstance may be instanced as operating against the tendency of the metals to follow this law of specific gravities, in the case of iron and tin. Iron has a sp. gr. of 7.8 while tin is only 7.2. The apparent sequence to this, according to the foregoing argument, would be that tin should be more plentiful than iron. We must here again, however, take into account the contingent circumstance that iron is much more readily oxidized than tin, and when once brought into that state has the low sp. gr. of 4 to 5. This will account for the fact that iron, notwithstanding its higher sp. gr. than tin, is much more abundant at the earth's surface than tin. These I give only as examples of the exceptional circumstances that require to be considered in framing the general proposition that the scarcity of a metal is in the ratio of its density.

These considerations seem to me to point distinctly to the presence of the heavier metals in much greater abundance in the interior of the earth than at its surface, and especially when taken in conjunction with the fact that the earth has a density twice as great as the minerals of which its crust is composed, and that notwithstanding the probability that it contains many great cavities filled with water or gases.—I am, &c.,

JOHN SUTHERLAND.

Glasgow.

GAS ABSORBED BY CHARCOAL.

To the Editor of the Chemical News.

SIR,—Your correspondent from New Zealand, Mr. William Skey, asks me, in No. 400 of the CHEMICAL NEWS, whether Drs. Blumtritt and Reichardt have proved—as he has—that incandescent charcoal absorbs nitrogen from the air?

They certainly have done so; their researches extend to a great many varieties of charcoal, both old and freshly ignited, and contain many full analyses of gas. The date of the first notice about them in the *Chemische Centralblatt* is September 12, 1866, and the paper is a reprint from the *Zeitschrift für deutsche Landwirthe*. The original publication must, therefore, be somewhat older, especially as the *Centralblatt* is generally several months behind; but at all events their priority of publication to Mr. Skey's communication cannot be doubted. However, it would be exceedingly unfair to say that this gentleman, living at such a distance from Europe, could in all probability have come across a German periodical, which would hardly have time to reach him in the interval between the publications; I expressly remarked in my letter in No. 372, that, "their paper has most likely not yet been noticed in English chemical periodicals." No one can have the slightest doubt that Mr. Skey has independently rediscovered the property of charcoal in question, although his opportunities in New Zealand could hardly allow him to extend his researches so systematically as those of the European savants.—I am, &c.,

G. L.

August 3, 1867.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

SIR,—I should not trouble you with a second letter on the above subject had not Mr. Newlands in his reply to my former note misquoted one of my sentences, and thereby entirely altered its meaning. The sentence should stand thus: "If the distance between the pole of a magnet, and a magnetic body be very considerable,

* After being heated strongly.

compared to the size of the latter, both the induced poles may be regarded as at the same distance," &c., &c.

A careful reconsideration of this sentence may perhaps convince Mr. Newlands, that it is in perfect harmony with all examples advanced by him, and may show him, that he is confounding the merely (or at least almost exclusively) directive action of one magnet, or pole, on another magnet at a great distance, with the attraction or repulsion exerted between two opposite poles. Thus, a small magnetized needle, when floated on water, places itself in the direction of the magnetic meridian; but why, if it does so by virtue of the superior attraction of the North pole, does it not also move in the direction of such pole? Does not the very fact of its remaining at rest in the direction of the meridian prove that the two forces of attraction and repulsion are sensibly equal? I would, in conclusion, recommend Mr. Newlands to make the following calculation: What is the difference between the forces of attraction and repulsion exerted on the poles of a magnetic needle 1 inch long by a magnetic pole several thousand miles distant, the needle pointing towards such pole? If, after having performed this calculation, according to the well-known law that the force of attraction or repulsion varies inversely as the square of the distance, he still believes that such difference may be a measurable amount, why—I hope that he will soon furnish the world with a description of the instrument by means of which he thinks to accomplish it.—I am, &c.,

A. D.

MISCELLANEOUS.

A New Science Scholarship.—On Friday, 26th ult., was celebrated the 30th anniversary of the City of London School, and upon that occasion a report was presented detailing the progress made towards the foundation of a *Testimonial Scholarship* in honour of the Rev. G. W. F. Mortimer, D.D., late head master, whose eminent services in the cause of education, and especially in the successful conduct of the school for a period of more than a quarter of a century, were deemed worthy of public and permanent recognition. For the purpose of giving effect to this resolution a committee, composed of old pupils of the school, and a few leading members of the Corporation, took the matter in hand shortly after Dr. Mortimer's retirement, and invited subscriptions, which already amount to about five hundred pounds. This sum will, it is believed, be further augmented, so that an annual grant of at least twenty pounds may be realised. It has now been proposed by Mr. Ernest Hart, one of the secretaries, to devote the proceeds to the encouragement of the study of science in the school, and, by granting an annual premium, assist in supporting a pupil either at the Royal College of Chemistry, or other scientific educational establishment of Great Britain. This proposal met with the hearty approval of the subscribers, and its expediency was strongly urged by Mr. Thomas Hall, B.A., who for twenty years past has conducted the science classes in the City of London School. When this suggestion has been finally decided upon we will inform our readers; in the meanwhile, it should be mentioned that there is already a medical scholarship (tenable for three years at St. Thomas's Hospital), and that Mr. Alderman Hale presents a silver medal for proficiency in chemical science, to be competed for annually by the pupils, all of whom, to the number of six hundred, are now taught chemistry as a branch of general education in the school. We notice the names of Mr. W. H. Perkin and Mr. J. Spiller among those acting on the committee, and in the list of subscribers to the Testimonial Fund are to be seen the names of several other chemists who received their early scientific training in the school. The treasurer, J. Sharp, Esq., LL.D., was also formerly one of Dr. Mortimer's pupils.

Composition and Quality of the Metropolitan Waters in July, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Names of Water Companies.	Total solid matter per gallon.	Loss by Ignition.*	Oxydisable organic matter.†	Hardness.	
				Before boiling.	After boiling.
<i>Thames Water Companies.</i>	Grains.	Grns.	Grains	Degs.	Degs.
Grand Junction . . .	18'67	0'75	0'82	12'5	4'0
West Middlesex . . .	17'44	0'60	0'71	12'5	3'5
Southwark and Vauxhall.†	18'16	0'42	0'71	12'5	4'0
Chelsea . . .	17'80	0'59	0'71	13'0	4'0
Lambeth . . .	17'51	0'72	0'80	12'5	3'5
<i>Other Companies.</i>					
Kent . . .	28'49	0'50	0'42	15'5	7'5
New River . . .	17'00	0'49	0'39	12'5	5'0
East London . . .	17'83	0'49	0'46	12'5	5'0

* The loss by ignition represents a variety of volatile matters, as well as organic matters, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxydisable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

The amount of ammonia in the water and of that derivable from organic nitrogen did not in any case exceed the 0'0094 of a grain per gallon of water, and there was no organic nitrogen or ammonia in the Kent water. It was, therefore, absolutely free from organic matter of an animal origin. H. LETHEBY, M.B.

The State of the Thames.—In a letter to the *Times* dated August 7th, "Y" writes, that last night during low water the characteristic stench of the Thames was distinctly perceived by several independent observers on the terrace at the Houses of Parliament, though in a less degree than in former times. As the water of the river is chemically examined from time to time by persons appointed by the Board of Health, it would be interesting to learn from them whether either the proportion or condition of the organic matter in the water will explain the unwelcome fact.

Economy of Light in Dark Alleys.—If in a very narrow street or lane, we look out of a window with the eye in the same plane as the outer face of the wall in which the window is placed, we shall see the whole of the sky by which the apartment can be illuminated. If we now withdraw the eye inwards, we shall gradually lose sight of the sky till it wholly disappears, which may take place when the eye is only *six or eight* inches from its first position. In such a case the apartment is illuminated only by the light reflected from the opposite wall, or the sides of the stones which form the window; because, if the glass of the window is *six or eight* inches within the wall, as it generally is, not a ray of light can fall upon it. If we now remove our window and substitute another in which all the panes of glass are roughly ground on the outside, and flush with the outer wall, the light from the whole of the visible sky and from the remotest parts of the opposite wall, will be introduced into the apartment, reflected from the innumerable faces or facets which the rough grinding of the glass has produced. The whole window will appear as if the sky were beyond it, and from every point of this luminous surface light will radiate into all parts of the room. In order to explain the superior effect of roughly ground glass, let us suppose that the ordinary window is replaced with a single sheet of the best glass inserted flush with the outer wall. The whole of the light from the visible portions of the sky will fall upon its surface, but at such an obliquity that four or five-sixths of it will be reflected outwards, and the other two or one-sixth, which is transmitted, will fall on the floor or on the shutters, and be of no value.—*Sir D. Brewster.*

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Journal für Praktische Chemie. April 4.

C. HEINTZEL "On Triamidophenol and Amidodimidophenol." K. FRISH "Researches on Creosote." A. W. HOFMANN "On the Transformation of the Aromatic Monamines into Acids containing a larger Proportion of Carbon." F. ROCHLEDER "On the Constituents of the Root Bark of the Apple Tree." "On the Elementary Analysis of Organic Substances." K. FRISH "On a Method of testing Fused Soda." SCHROTTER "On some Nickeliferous Cobalt Ore from Dobschau." HLASIWETZ and GRABOWSKI "On Carminic Acid." HLASIWETZ "On Caffeic Acid." F. ROCHLEDER "On the Action of Nascent Hydrogen on Chinine, Cinchonine, and Caffeine."

April 15, 1867.

W. MICHAELIS "On Portland Cement." PETERSON "Analysis of Apatite from Diez, in Nassau." A. BAEYER "On the Constitution of Mellitic Acid."

Le Technologiste. May 1867.

W. NAYLOR "On Smoke-consuming Furnaces." W. DE LA RUE and H. MULLER "On the Extraction of Copper and Silver from Iron Pyrites." G. LUNGE "On the Manufacture of Nitrate of Potash and of pure Carbonate of Potash." C. DIETRICH "On the Preparation of Chrome Green."

Journal des Fabricants de Papier. March 15, 1867.

E. BOURDILLIAT "On Testing the Chemical Products used in Paper Making." E. A. COTELLES "Apparatus for utilising Chlorine Residues." TAQUET "A Method of Removing Boiler Scale by Means of Potash." J. M. MELLOR "A Method of softening, separating, and bleaching Vegetable Fibres."

April 1.

E. BOURDILLIAT "On testing the Chemical Products used in Paper-making." A. OTT "On the use of Petroleum for lubricating Machinery." CRANE "A new Safety Paper for preventing Bank Note Forgeries."

April 15.

E. BOURDILLIAT "On testing the Chemical Products used in Paper-making." H. BERGE "On Lignite from Moldavia."

May 1.

E. BOURDILLIAT "On testing the Chemical Products used in Paper-making." "On the Estimation of Wood Pulp in its dry State."

Genie Industriel. May, 1867.

P. DU RIEUX and ROETTER "An Improved Cylindrical Filter Press." BLOCH "A Method of joining Lead and other Metal Tubes." C. STAMMER "On the comparative Advantages of Washing Sugar Filters with Hot and Cold Water." T. GRAY "On the Preparation and Treatment of Flax and Hemp." MARECHAL and T. DU MOTAY "On Bleaching Animal and Vegetable Fibres." "On the Use of Kamptulion as Armour Plating." GUENIER-LAURIC "A Method of Casting Rolls, Columns, and Guns with an external Skin of Hard Iron." LEVEQUE "Apparatus for charging and collecting Gases from Blast Furnaces." SCHLOTTERBEK "Varnish for protecting the Surface of Iron from Rust."

Sitzungsberichte der Wiener Akademie (Mathematical and Physical Section. December, 1866.

W. F. GINTL "A new Pinch Cock for stopping India Rubber Tubes." F. ROCHLEDER "On the Elementary Analysis of Organic Substances." K. FRITZ "On the periodical Phenomena of Plants." "On the ripening of Seeds and Fruits in Australia." A. BRIO "On the Crystalline Form of Fomiate of Baryta."

Comptes Rendus. No. 19.

BEQUEREL "Memoir on some newly-discovered Chemical Effects of Capillary Action." BOUSSINGAULT "On the Effect of Mercury Vapours on Flowers." C. DEVILLE "On the Periodical Variations of Temperature." CIVIALE "Description of a Collection of Urinary Calculi, classified according to their Structure and Development." C. BRIOT "On Crystalline Reflection and Refraction." POTIER "Researches on the Diffraction of Polarised Light." H. MARIE-DAVY "On the 'Electric Mass' of Conductors." P. P. DEHERAIN "Experimental Researches on the Use of Potash Salts in Agriculture." J. J. CHYDENIUS "On Pseudo-Hexyl-Urea." E. GRIMAU "On the Brominated Derivatives of Gallic Acid."

Annalen der Chemie und Pharmacie. April 1867.

C. D. BRAUN "On the Formation of Certain Cobalt Amine Compounds." C. ENGLER "On the Action of Bromine on some Nitriles." "On the Action of Ammonia on Trichlorhydrine." R. OTTO and O. VON GRUBER "On Toluol-sulphuric Acid." R. OTTO "A simple Method of preparing Crystallised Sesquioxide of Chromium." C. WELTZEN "On the Hydrated Sesquioxide and Oxide of Silver." "On the Formation of Ozone." A. SIERSCHE "On the Preparation of the Fatty Alcohols from their Primary Members."

May.

L. CARIUS, "On the Synthesis of Organic Acids." E. SCHULZ and A. REINECKE, "On the Analysis of Animal Fats, especially those of Mutton, Beef, and Pork." H. HLASIWETZ, "On some Tannic Acids." H. HLASIWETZ, "On the Brominated Derivatives of Gallic Acid, and Oxypheic Acid." GUCKELBERGER, "On the Extraction of Thallium."

NOTES AND QUERIES.

Stearic Acid in Paraffin.—Sir,—In reply to your correspondent "X's" query in last week's CHEMICAL NEWS, I can recommend him to try Wagner's test. Dissolve the suspected paraffin in boiling alcohol, and add to it an alcoholic solution of acetate of lead. If stearic acid be present a white precipitate will fall of stearate of lead, but if the paraffin be pure no precipitation will take place. I can speak from experience as to the value of this process.—B. HOFFMAN.

Wires for Micrometers.—Sir,—I think perhaps the best thing your correspondent, "O. Ramsbottom," can use for the above purpose is asbestos. This was suggested many years ago by Professor Wallace, who states that fibres of this substance of the 1-3000th of an inch in diameter give a line beautifully even under the microscope and of considerable opacity; the subdivision of the substance can be carried to almost any degree of minuteness.—J. S. S.

Nitrogen, Preparation of.—Sir,—"Theta" will probably find the following plan answer his purpose:—Half fill a tubulated retort with dry nitrate of ammonia. By means of a wire passing stiffly through a cork in the tubulus suspend a piece of zinc so that it can be moved up and down at will. Fuse the nitrate of ammonia by heat, and then push the zinc down into it. Nitrogen and ammonia will be evolved, and the latter can be absorbed by collecting over water or by passing through Woulff's bottles containing water and dilute acid. By adjusting the height of the zinc and the temperature of the salt the disengagement of gas may be varied as desired.—S. PETERSON.

Picric Acid.—Sir,—Out of the many works on chemistry that I have, besides the last seven volumes of the CHEMICAL NEWS, I have not in them all a good process for making picric acid. All the processes that one reads are thus:—Picric acid is formed by acting on carbolic acid with nitric acid, assisted by a little heat. Now, what I want to know is, the proportions of carbolic acid and nitric acid, and the strength of the nitric acid, and the degree of heat, and the length of heat, and the length of time that it has to be heated; or, in other words, a good process for making it. If you can give me the above information through the NEWS, I shall feel extremely obliged.—S. R.

Nitrogen, Preparation of.—A correspondent informs us, in answer to the query on this subject, that the best way to prepare nitrogen is to react on dilute ammonia with bromine. The ammonia is to be put into a tubulated retort, or Woulff's bottle, and the bromine poured in through a funnel-tube reaching to the bottom. Nitrogen comes off freely, and may be collected over water. No bromide of nitrogen is formed. The product is bromide of ammonium.

Oxalate of Cerium—Silicide of Aluminium.—Sir,—Could any of your correspondents inform me what remains on igniting the oxalate of cerium, and how to obtain silicide of aluminium?—C. R. N. P.

A Specific Gravity Problem.—Sir,—Might I, through your valuable column of Notes and Queries, ask assistance in the following case:—In examining some meteoric iron I found its sp. gr. (using 50 grains) to be 6.1, but as this iron was intimately mixed with olivine, I afterwards dissolved out the iron in acid, and found that 20 grs. olivine were left behind, which had the specific gravity of 3.2. Now, how can I calculate the true specific gravity of the 30 grains iron actually present? I have no doubt that some of your correspondents can help me in this dilemma.

αιδερος.

ANSWERS TO CORRESPONDENTS.

Table of Contents.—In deference to the strongly-expressed wishes of many correspondents, it has been decided to resume the weekly table of contents on the front page of the CHEMICAL NEWS.

Paris Exhibition.—Our correspondent's weekly article did not arrive till too late for insertion in this number.

Effra.—Tannate of alumina may be prepared by grinding together in a mortar equal equivalents of freshly precipitated alumina and tannic acid. Wash and dry spontaneously.

Filhol.—A letter will be sent by post. The subject is one unsuitable for this column.

B. Y. G.—The best thing to remove grease stains from silk is ether. If you use methylated the expense will be trifling.

E. J.—The patent was taken out on March 2, 1862. See the CHEMICAL NEWS for July 26, 1862, p. 55.

A Bee.—Permanganic acid is volatile, and may be distilled with caution, but the operation is not unattended with danger, as it sometimes explodes.

A Reader from the first.—The crystals have been examined and prove to be acetate of morphia. The quantity you name is a highly dangerous dose.

C. Porter.—The best enamel to use is boro-silicate of soda. This is not attacked by vinegar, salt, or other ingredients used in cooking. The silicate of lead which is sometimes used as an enamel, gives up its lead to many liquids. It should, therefore, be carefully avoided in manufacturing utensils for the kitchen.

Artist.—Constant white is the trade name for sulphate of baryta.

Communications have been received from Townsend and Adams, New York; Dr. E. Rohrig (with enclosure); C. R. A. Wright, B.Sc.; Radcliffe and Layton (with enclosure); F. Maxwell Lyte; A. Bird; Dr. Lunge; J. C. Bell; Dr. E. A. Cook; F. Vikars; J. Dodd (with enclosure); M. Farquarson; S. E. Wood (with enclosure); L. Hughes; Dr. Anderson (with enclosure); J. Taylor; G. A. Keyworth; E. Scott; W. Bailey; S. Robertson (with enclosure); Professor Church, M.A.; C. Tomlinson, F.R.S.; Harold Thompson; A. Jones; E. Maxwell, United States.

THE CHEMICAL NEWS.

VOL. XVI., No. 402.

ON THE ACTION OF CHLORINE ON CARBONATE OF SILVER. PREPARATION OF CHLORATE OF SILVER.

By Professor J. S. STAS.

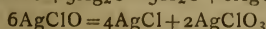
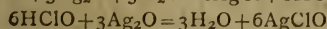
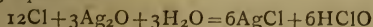
If oxide or carbonate of silver suspended in water is diffused through an excess of saturated chlorine water, the silver is completely changed into chloride, as in the case of oxide and carbonate of mercury; and the water only contains besides the excess of chlorine pure hypochlorous acid, without a trace of chloric or perchloric acid. The chlorometric standard of the liquid, after the chlorine has acted on the carbonate, is almost identical with that of the chlorine water employed.

By passing a slow current of chlorine, with constant agitation, into water containing an excess of carbonate of silver in suspension, the first action is identical; there are still produced chloride of silver and hypochlorous acid, but this hypochlorous acid only remains momentarily free, it slowly transforms another part of the carbonate into metallic hypochlorite. Indeed, if at the end of a short time the current of chlorine is interrupted, the agitation being continued all the time, the liquid loses the characteristic odour of hypochlorous acid, but preserves its energetic decolorising power, because the hypochlorite of silver which is formed is very soluble in water.

Hypochlorite of silver, which to my knowledge has never before been described, is sufficiently stable in the presence of an excess of carbonate of silver, to remain undecomposed for several days; it is, on the contrary, very instable in the absence of this metallic oxide or carbonate. It has, indeed, appeared to me that so long as the solution of hypochlorite of silver is kept agitated with the carbonate the liquid preserves its transparency and decolorising power; if, on the contrary, it is left at rest, scarcely has the carbonate of silver settled when the limpid liquid becomes opalescent, and soon deposits large flakes of chloride of silver, which cover with a white coating the carbonate of silver at first deposited. The liquid at the same time loses its decolorising power, and only contains chlorate of silver in solution, rendered alkaline by a small excess of carbonate dissolved.

According to what I have here shown, it is evident that the formation of chlorate of silver by the action of chlorine on the carbonate, is the result of a secondary reaction of the hypochlorite of that metal which is previously formed. It would appear, moreover, as if all other chlorates were formed in a similar manner, but this is not the place to enter into this question.

The successive reactions may be represented by the following equations:—



I may say that argentic hypochlorite is very soluble in water; indeed, the clear liquid containing carbonate of silver suspended in it, and through which a slow current of chlorine has been passing for some hours, contains a considerable quantity of hypochlorite, which remains intact so long as it is in contact with the carbonate; but the excess of carbonate employed fixes on itself a large quantity of this hypochlorite, or, at all events, of the elements of this salt. The fixation of hypochlorite on this very slightly soluble argentic compound, results from two facts observed during the four times I have produced chlorate of silver by the action of chlorine on the carbonate and oxide. The first is the im-

possibility of washing these bodies after chlorine has acted on them for a certain time. Whatever care is taken, and however the washing is effected, the water always contains, besides the carbonate, a salt of silver containing chlorine and oxygen; the second fact is, that the carbonate on which chlorine has acted for a sufficient time to produce hypochlorite in solution, will still, after washing, furnish, under the influence of chlorine, a fresh quantity of hypochlorite, much more considerable than that which could result from the chlorine used in this second reaction. Observation has even proved that the greatest production of soluble hypochlorite takes place when two-thirds of the carbonate have been already submitted to the decomposing action of the chlorine.

Hypochlorite of silver is the sole silver salt that is formed by the action of chlorine on an excess of oxide or carbonate of silver suspended in the liquid and kept in a state of continual agitation. Spontaneous decomposition, or decomposition effected by the aid of heat, never produces the least trace of perchlorate when I have operated on a hypochlorite rendered slightly alkaline by an excess of carbonate in solution. During the passage of the chlorine, the hypochlorite which is formed may be destroyed again with formation of chloride of silver; but hypochlorous acid is still formed under these circumstances, and by reacting on a fresh quantity of carbonate of silver, a double quantity of hypochlorite is reproduced.

The conditions necessary to form chlorate of silver, according to the above observations are therefore these:—A slow current of chlorine must react on the carbonate of silver (previously treated with chlorine to remove the alkali which it may contain) suspended in water and kept constantly in agitation until the chlorine has attacked the greater portion of the argentic compound employed; this agitation must be continued after the interruption of the current of chlorine, so as to change the free hypochlorous acid existing in the liquid into hypochlorite; the solution of argentic hypochlorite must be separated from the excess of the argentic compound employed in the first instance, so that the hypochlorite may change spontaneously into chloride and chlorate. The following is a description of the arrangement I adopted, so as to satisfy, as far as possible, the above conditions:—

Three kilogrammes and 935 grammes of nitrate of silver, free from foreign metals, were dissolved in twenty litres of distilled water; the solution was poured, in small quantities at a time, into an equal volume of solution of carbonate of potassium prepared from pure cream of tartar. The carbonate of silver, which was voluminous, and of a very pale yellowish white, after having been kept for a long time suspended in an excess of solution of carbonate of potassium, was washed by decantation in the cold until no more potassium could be detected in the residue left by the washing water after evaporation to dryness. To arrive at this point I was obliged each time to violently shake up the carbonate of silver with water in a closed flask, as is done in a silver assay, to clarify the liquid. Taking these precautions, the washings lasted for fifteen days, repeating them several times a day.

The thin paste of carbonate of silver (which from its original yellowish white, had become of a beautiful yellow colour) was introduced into a flask of 45 litres capacity, covered with black cloth. This flask was fixed firmly in a frame attached to a kind of stirrup suspended above the ground by long cords. At each side, and at the foot of this stirrup, a string was fixed, and by alternately exerting a tractive movement by these strings, as strong an oscillatory movement as is desired could be communicated to the flask. To the neck of the flask was affixed a glass stopper pierced with two holes, one of which allowed the passage of a glass tube bent at right angles and leading the chlorine into the liquid, and the other admitted a glass tube, likewise bent, which allowed the escape of the carbonic anhydride set at liberty by the decomposition of the carbonate of silver. The tube by which chlorine was pas-

sed into the liquid was connected with a chlorine generating apparatus, by means of a vulcanised caoutchouc tube, long enough to permit free oscillation of the apparatus without exerting traction on the chlorine apparatus. The vulcanised caoutchouc tube had been boiled for an hour with a ten per cent solution of hydrate of sodium to desulphurise it, and was then washed with pure water.

The apparatus being so arranged I allowed a *very slow* current of chlorine* to pass into the flask for an hour and a quarter, keeping it during the whole of this time in continuous movement. I then stopped the current of chlorine and continued to agitate the liquid so long as it exhaled the least odour of hypochlorous acid. The apparatus was then left at rest and the strongly coloured supernatant liquid was decanted. The carbonate of silver was then washed again by decantation, the first liquid decanted being added to the solution of hypochlorite already separated. The carbonate of silver was washed as long as it was possible to ascertain by aid of the spectroscope any traces of potassium in the residue left after evaporating the washing waters to dryness.

The solution of hypochlorite of silver, after having been preserved in darkness until it ceased to deposit chloride of silver, was evaporated to dryness; it left 31·819 grammes of a white saline residue.

The washed carbonate of silver, in the form of thin paste, was now introduced, with four litres of water, into the flask, and exposed for two hours to a current of chlorine, the agitation being incessant the whole time, and being kept up after the current of chlorine was stopped so long as the mixture smelt of hypochlorous acid. It furnished by decantation five litres of a strongly decolorising solution, which, left in darkness to spontaneous decomposition, yielded on evaporation 58·237 grammes of chlorate of silver.

The carbonate of silver was now washed for a third time. Already in the first washing water it was impossible for me to discover the least trace of potassium, by the aid of spectrum analysis, on examining the residue left by a whole litre of liquid.

I then diffused the carbonate of silver in a volume of water equal to that of the liquid decanted off, and for three hours exposed it to an uninterrupted current of chlorine with continual agitation. After the current of chlorine was stopped the mixture was kept in agitation for half-an-hour; after decantation the clear and colourless liquid did not emit the least odour of hypochlorous acid, but it had strong bleaching properties. On standing it deposited large quantities of chloride of silver, and on evaporation yielded 72 grammes of chlorate of silver.

Finally, the carbonate of silver, mixed with a considerable quantity of chloride of silver, was washed for a fourth time. Diffused through six litres of pure water it was exposed for six hours in the vibrating flask to a continuous current of chlorine. The hypochlorous acid having been changed into hypochlorite of silver by agitating the liquid with the remaining excess of carbonate of silver, I left the liquid to repose till all the hypochlorite was changed into chlorate and chloride. On evaporating the clear liquid with the usual precautions, I obtained in this operation 23 grammes of chlorate of silver.

I ceased acting with chlorine on the carbonate of silver because the salt was so whitened by admixture with chloride of silver that it was impossible by sight alone to distinguish whether any were present or not. Besides, when I stopped the operation the evaporation of all the liquids was not finished sufficiently for me to know how much chlorate was formed. On the supposition that the chlorine had acted to its fullest extent, I ought to have obtained 700 grammes of chlorate, but the total weight of

the salt left on evaporating the four decanted liquids only came to 285 grammes. I had only produced two-fifths of the theoretical quantity, and it was therefore impossible to have obtained any perchlorate of silver.

The chlorates obtained in these operations were submitted to the following treatment:—

A portion of the 31·819 grammes obtained in the first operation having been examined in the spectroscope, was found to contain much chlorate of potassium. I did not therefore purify it.

The 58·237 grammes of chlorate from the second operation were dissolved in cold water. The solution was found to be faintly alkaline. Dilute chlorine water was added to it so as to cause the alkaline reaction to disappear, and it was then boiled in order to precipitate the traces of chloride of silver thereby produced. The perfectly neutral liquid was decanted and evaporated. Three separate crops of crystals were obtained from it. Each of these was separately reduced to the state of chloride by means of sulphurous anhydride.

A current of sulphurous anhydride precipitates sulphite of silver from a solution of chlorate, and the liquid contains chloric acid. This sulphite of silver only passes to the state of chloride by the consecutive action of sulphurous anhydride on chloric acid. During the passage of the gas there is, however, no way of telling whether the reduction of the chloric acid is partial or total, whether there is too little or an excess of sulphurous acid, and the amount of the excess. Another difficulty is occasioned by the relative slowness with which sulphurous acid reduces at 0°C. very dilute chloric acid; and, notwithstanding this, a low temperature and a great dilution of the liquid are indispensable conditions of success. I have, therefore, effected the reductions of chlorate of silver by means of a standard solution of sulphurous acid.

I now return to the three portions of chlorate of silver obtained from the 58·237 grammes of the second operation. The first portion containing the least soluble salts, still contained potassium, as shown by spectrum analysis. The second portion I lost in an attempt to reduce it in a current of sulphurous anhydride gas; the third part, weighing 123·932 grammes, was reduced by a standard solution of sulphurous acid at 0°C.

The 72 grammes of chlorate of silver produced in the third operation were dissolved in cold water. The solution was opalescent, and appreciably alkaline. I added carefully, dilute chlorine water till the alkaline reaction disappeared, then heated to precipitate the chloride of silver formed, and evaporated the decanted liquid over a water bath till a pellicle was formed. In order to obtain the chlorate in small crystals the liquid was cooled suddenly. The mother liquor was removed by aspiration. The chlorate was washed three times with ice cold water. After drying over sulphuric acid there remained 40·336 grammes of chlorate of silver, white and unalterable in the light. The washing waters and mother liquors yielded 27·581 grammes of salt equally white and unalterable in the light, but extraordinarily changeable by exposure to the air.

These 40·336 grammes of chlorate were added to the salt obtained from the 123·500 grammes yielded by the fourth operation. In order to free it from the perchlorate which, in spite of every precaution it might contain, I submitted it to the following treatment:—

It was dissolved in cold water, and the solution was mixed with dilute chlorine water until the very slight alkaline reaction which it at first possessed, had disappeared. The liquid was then boiled to precipitate the traces of chloride of silver thus produced. The clear liquid was then decanted, evaporated over a water-bath till a pellicle formed, and cooled quickly. The mother liquor was removed by aspiration, and the crystals washed with ice cold water; all the washings, except the first, were evaporated, till a pellicle formed, and the same treatment pursued in their case. After repeating the crystallisations, the washings, and evaporations, I suc-

* The binoxide of manganese employed in the preparation of chlorine, after being finely powdered, was treated with dilute, boiling sulphuric acid so as to completely free it from the nitro-compounds which it always contains; it was then washed in pure water. This treatment is indispensable when chlorine is required absolutely free from chloride of azotyle.

ceeded in obtaining from the 123·5 grammes originally taken about 99 grammes of chlorate of silver, which I consider is as pure as can possibly be obtained. The mother liquors, which I carefully kept separated, yielded pure chlorate to the last trace. The preparation of chlorate of silver in the manner above described, I consider to be the most laborious and delicate operation which can be performed in analytical researches.

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

FATIGUED with wandering from case to case to make comparisons between English and foreign manufacturers (for, owing to the perhaps inevitable distance between them, your correspondent at times has had to walk miles in this way), it was a relief to come at last to a case where attempts at comparison would have been useless. I allude to the, in many respects, unrivalled display of Messrs. Howard and Sons, of Stratford. Their name has for many years held an enviable position with regard to the purity and beauty of their chemicals, and the contents of their case fully sustain their old reputation. In the English catalogue they are described thus:—"48. Howard's and Sons, Stratford, near London, salts of quinine, and other chemicals."

Among the many remedial agents which organic chemistry has afforded us, quinine occupies the first place, chloroform the second. Without quinine, large tracts, indeed whole countries, would be simply uninhabitable for Europeans. To the backwoodsman a supply of quinine is as important as gunpowder. The "quinine famine" in the Mauritius demonstrated to thousands how small a thing even gold itself might become in comparison with the life-saving salt.

If the search for artificial quinine has been as unsuccessful as that for the Philosopher's Stone, it has at least resulted also in some great discoveries. It does not appear to be generally known that the first of the aniline colours was discovered during a search for artificial quinine! But, tired of waiting for that which did not come, finding that chemists could not produce quinine, it struck certain minds that it would be a surer plan to assist Nature a little, and Nature, as she always does when properly called upon, responded liberally. In effect, owing to the wasteful and ignorant manner in which bark was collected in its old habitat, it was, especially in the finer and richer varieties getting scarcer, this circumstance has induced certain enterprising men to cause the cinchonas to be introduced into India, and it has not only been found that the change of habitat does not prevent the development of quinine, but the valuable discovery has been made by McIvor, and confirmed by De Vrij, that covering the bark during its growth with moss increases the percentage of alkaloids. The cinchona plantations in India are now so flourishing that there need be no apprehension of the supply of quinine ever failing, and if the discovery of artificial quinine should ever now be made, it would have to depend upon its value for its cheapness. We are aware that the discovery of artificial quinine has more than once been announced, but up to the present time such announcements have never been supported by positive evidence.

Messrs. Howards show an unrivalled collection of barks including several from the new Indian plantations, and a specimen grown in England by Mr. J. E. Howard. It is exceedingly interesting to find that this English bark, also contained quinine, for a specimen of the alkaloid extracted from it and its sulphate are exhibited. In addition to the above this remarkable case contains specimens of the following alkaloids or their sulphates:—

Quinine	$C_{20}H_{24}N_2O_2$
Quinidine	$C_{20}H_{24}N_2O_2$
Cinchonine	$C_{23}H_{24}N_2O$
Cinchonidine	$C_{20}H_{24}N_2O$
Aricine	$C_{23}H_{26}N_2O_4$

It appears to your correspondent that an attempt to convert quinidine, cinchonine, or cinchonidine into quinine would be far more likely to meet with success than any efforts to produce that alkaloid by building it up step by step, and considering the enormous quantities of cinchonine which have been accumulated by quinine manufacturers, and are almost valueless, it is evident that such a discovery, however hopeless it may look at present, is well worth an effort. It must not be forgotten moreover, that researches of this kind, if carried on by competent persons, are certain to be fruitful in discoveries; even if the great end sought for be not attained. The admirable experiments of Pasteur are quite enough to prove the truth of this assertion.

In addition to the above, Messrs. Howard exhibit numerous chemicals of the highest possible quality. Amongst them is benzoic acid, on the perfect purity of which they pride themselves. It is free from the slightest admixture of the hippuro-benzoic acid, made by boiling hippuric acid (from the urine of cattle) with hydrochloric acid. This artificial benzoic acid is largely imported from the continent and sold as the genuine article. The acid thus produced is, however, never quite free from the peculiar odour of the urine of herbivorous animals, and, no matter how carefully purified, is without the fragrance which characterises it as obtained by sublimation from gum benzoin. This has induced some unscrupulous persons to mix a portion of the acid from benzoin with that from urine, in order that the fragrance of the one may carry the other off.

The tartaric and citric acids exhibited by this firm are in superb crystals and have the appearance of being in the highest possible state of purity.

A curiosity in its way is carbonate of ammonium, prepared entirely from volcanic products, and therefore free from the impurities of which traces are almost always to be found in the salt as obtained from the crude sulphate of ammonia of the tar distilleries. As is well known, crude boracic acid from Tuscany often contains borate, sulphate, and chloride of ammonium. One sample analysed by Wittstein contained no less than eight-and-a-half per cent of sulphate of ammonium. The carbonate of ammonium shown by the Messrs. Howard is obtained in their process for preparing borax from the crude boracic acid of commerce, and is therefore, as they say, of purely volcanic origin. We believe there is no other firm who prepare salts of ammonium from the same source. The morphia and its salts shown in the same case appear of very fine quality, and the same remark may be made with regard to their mercurial preparations. I am much pleased to see that the admirable display I have described, had obtained the distinction of a gold medal.

Popular Scientific Information.—The following paragraph, from the pages of a weekly contemporary which makes great pretensions to accuracy, shows the kind of science on which the mining public are fed:—"An invention has been provisionally specified by Mr. Bonneville, of Paris, for obtaining white lead direct from the ore, by pouring the molten metal into cold water, to render it as porous and bulky as possible; it is then dissolved in sulphuric acid, and the sulphate is treated with pyroligneous or oxalic acid, combined or not with tinctal dissolved in water, and next dried over the fire on ways. The vessels employed are either made of stone or wood, lined with lead, which become coated with a protecting covering of lead."

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, AUG 13, 1867.

Mother of Pearl Colours applied to Porcelain.—Improvements in Calico Printing.—Engraving on Glass with Hydrofluoric Acid.—Polychromic Impressions on Porcelain.—The Spherometer.—The Exhibition Awards.—Security from Fire.—Steel Wire Drawing.—Cheap production of Oxygen.—Bleaching with Fluosilicic and Sulphurous Acids.

WE have already mentioned that the Society for the Encouragement of National Industry holds, during the Exhibition, weekly instead of monthly meetings.

At the meeting on July 26, M. Maillard invited the Society to attend his experiments on the next day, at Avenue Montaigne, No. 21, Paris, to show the superiority, as regards security from fire, of his mineral roof-sheeting, compared with that of zinc or tiles. [We learn since that the tiles and zinc gave way at once, while the new mineral covering resisted the effects of fire.]

M. Lavollée read, in the name of the Committee of Commerce, a report by M. Legentil on the manufactory of M. Teste, established at Lyons, for steel wire-drawing, in which he employs infirm workmen. This establishment has quintupled its importance in spite of the reduction of the prices resulting from the treaties of commerce, it has more extended relations with foreign countries, and in it are fabricated all important objects of steel wire-work; needles, umbrella-ribs, knitting-needles, crochets, enamelled-headed pins, pivots for different trades, springs for crinolines and corsets, &c. M. Teste announced that he employs 246 workmen and workwomen, 100 of which are employed at their homes. Besides these latter he employs about 120 young infirm females who have found a refuge in a religious institution, established near his works, and called the Sainte-Elizabeth Providence of the infirm.

On the 2nd of August, 1867, M. Chevallier in the chair, a meeting was held in which M. Salvétat presented a report on mother-of-pearl colours applied to the decoration of crystal and porcelain, made by M. Briançon, decorator, Paris. He remarked that the pearl varnishes of M. Briançon were eight years ago objects of examination and encouragement on the part of the Society. Since then the method has been extended to new applications, and has met with much encouragement abroad; thus we observe in the Exhibition a great number of pieces of pearly porcelain in the Belgian, Italian, Spanish, Prussian, Austrian, and Russian sections. The employment of bismuth for this purpose originated, according to Mr. Salvétat, in France.

M. Schutzenberger, professor of chemistry at the College of France, gave a very interesting lecture on his improvements in the printing of woven stuffs during the last few years. The mechanical principles adopted are the same as formerly; the means of engraving the plates have been much improved, and blocks of fusible metal are now oftener employed; also, the impression by engraved rollers has come more generally into use. Machines have been constructed for printing at one operation eight to twelve colours, and in England they go as far as twenty-four colours. The rollers are of cast iron covered with copper, and the engraving is made by the ordinary means of aquafortis; the chemical processes were the object of more extended study, since eight or twelve colours have to be fixed on the tissue by one and the same means, as they are applied simultaneously. Albumen is one of the substances most generally used. It coagulates at the boiling point of water, and retains and fixes on the tissues the colouring matter with which it is charged; it also forms a mordant for applying, on cotton, colours derived from aniline which can only be fixed by nitrogenized substances. The lecturer detailed also the processes employed in the use of garancine or madder colours, and went into a very ample description of aniline

colours and their improvement, and he dwelt upon the stability and indestructibility of aniline black.

M. Peligot, member of the council, explained the processes generally in use, for engraving on glass by hydrofluoric acid. This acid in a liquid state gives a polished and transparent surface to the glass, and is useful for making decorative designs on white glass lined with coloured glass. Dull engravings on glass are obtained by the use of neutral fluorides, to which acid has been added. M. Kessler applies these processes at Baccarat; they are also used at Saint Louis. This last establishment consumes annually 800 kilog. of hydrofluoric acid; Baccarat employs more. The designs are first drawn on stone, and proofs are taken off with an ink containing wax and bitumen, on unsized paper, coated with starch first, then with gum, and thirdly with collodion. When the sheet is applied to the glass, the paper is washed off with water, leaving only the impression and the coating of collodion which covers it. A similar proceeding is employed for polychromic impressions upon porcelain, the collodion being burned off in the fire. Five hundred large sheets of glass engraved in this manner measuring 2m. 20c. long by 60c. wide, have been made, for the establishments of M. Duval in Paris.

M. Perreux, engineer, explained the principles of his *spherometer*. It consists of a screw, the pitch of which is a quarter of a millimètre, and a circle divided into 500 parts, so as to obtain the graduation of 1-2000th of a millimètre. He also explained the construction of a self-acting machine, capable of marking, in a right line, divisions visible by the microscope, only the thousandth part of a millimètre asunder.

Among the many persons of great merit in the French section of the Exhibition who have been either badly rewarded, or passed over in silence, we cite the following: M. Collas, the pioneer of benzol, inventor of nitro-benzol, and classed by the Society of Mulhouse among the discoverers of aniline colours; he has exhibited at the Paris Exhibition two important discoveries, and the jury have not awarded him even honourable mention. What has become of the medal certainly awarded to him by the jury at the first meetings?

M. Dubrunfaut, discoverer of the application of osmose to the extraction of sugars, exhibited by M. Camichel de la tour du Piu (Isere), a successful operation, greatly extolled in three lectures, by M. Payen, a most excellent judge, at the *Conservatoire des Arts et Metiers*, at the Sorbonne, and at the Society of Encouragement, has been completely ignored.

The "Mille" gaz, and gazo-lamp, the former of which is remarkable for the facility with which gas is produced without any mechanical agent or fire, by an apparatus easily put up anywhere; and the latter now sold by thousands all over Paris and in the Provinces, besides being exhibited in hundreds of different shapes and designs at the Exhibition, do not figure even in the catalogue.

A noble widow, Madame de Clercq, spent £140,000 in order to render the commune of Oignies, in the Pas de Calais, in which she resides, a terrestrial paradise. She has constructed at her expense a vast church, an asylum, a school and work-room for girls, a boy's school, a house of patronage for youth, an asylum for the aged, cheap dwellings, &c.; she has founded courses of studies for adults, Sunday-schools, a library, a club, recreation and exercise rooms, with medical consultation, a savings' bank, &c. A group of neighbouring roads has also been organized and kept in repair, more than 400 acres of land have been cleared and let out to 550 families, a coal mine has been sunk, and water supply given to the town, now numbering 1800 souls, all at the expense of this lady, to whom the jury have awarded the humble prize of a silver medal!

The aim of the Agricultural Society of Entomology is to contribute to the multiplication of useful insects, and to promulgate the means of destruction of noxious

ones. It is composed of honorary and titular members, without any limit as to their number. The title of honorary member can be conferred on persons who, by their publications and works, forward the views of the Society. It can be also conferred upon persons who aid the Society by their patronage or donations.

Any person, without distinction of residence or nationality, can be received as titular member and correspondent of the Society, by being presented by a member of the Council, adhering to the statutes, and paying ten francs per annum. From time to time reports are issued relative to the multiplication of insects useful to man, and the destruction of those hurtful, indicating the rational means of healthy development; in the other case the most ready method of extirpation. There are being formed a library, collections, and a museum; also, the documents and papers received are centralised and classified, and those intended for publication are indicated. An enquiry office has been instituted, in which interested parties can obtain information on the insects about which they desire it.

Every two years an exhibition is organised, in Paris, of useful insects, their products and apparatus adapted to their cultivation; and of noxious insects, the ravages caused by them and their means of destruction.

The process for the cheap production of oxygen by M. Tessie de Motay, has perfectly succeeded in the laboratory of the Exhibition established on the banks of the Seine. The new method, so simple and efficacious, has fulfilled all expectations. Fifty kilogs. of manganate of soda give 400 to 450 litres of oxygen per hour, after eighty successive re-oxidations. M. Tessie de Motay has so perfected the fabrication of manganate of soda, that he is almost certain of being able to furnish it to the trade at the price of 30 or 40 centimes the kilogramme. The necessary arrangements for essaying on a large scale the oxyhydrogen light at the Hotel de Ville, in the square as well as in the interior, advance rapidly, and the generators are fitted up already in the cellars. Oxygen and common gas burned together in common burners increase the illuminating power from 1 to 8 or even 15, or can serve at the same time for burning in the chloride of magnesium lamps of M. Carlevaris, which do excellent service.

In order that the essays of spontaneous bleaching with fluosilicic acid and sulphurous acid could completely succeed, it was necessary to render as cheap as possible the production of manganate of soda. Applied to pulp of wood and straw it gave such excellent results that the manufacturers themselves scarcely knew whether they were treating rag-pulp or straw-pulp. F. MOIGNO.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

AUGUST 5, 1867.

(FROM OUR OWN CORRESPONDENT.)

Fall of Aerolites.—Ozonometry.—Oxide of Thallium a Test for Ozone.—Theory of Solar Spots.—Wax of the Fig Cochineal.—Moulting of Fishes.

The minister of public instruction transmitted, on behalf of the Algerian Government, several documents relative to the fall of aerolites which took place on the 9th of May, 1866, preceded by the appearance of a *bolide*, or meteor, which exploded with very loud reports.

Dr. Besigny presented a memoir on ozonometry, being a *resumé* of observations made during a period of nine consecutive years with iodized paper much more sensitive than that of Schönbein, and a scale of shades drawn up in concert with M. Salleron. The following are the principal results obtained at Versailles; the month of May is that during which the maxima are absolute, in November the absolute minima take place. At the equinoctial periods,

March and September, ozone attains its relative maxima. The importance of the months is ranged in the following progressive order: May, March, April, June, August, July, September, January, December, October, February, and November. The comparison of the ozonometric curves with the meteorological charts of the observatory show that a maximum of ozone corresponds with the presence of a storm in Europe, on the Atlantic, or on the coasts of France and England. Certain minima follow the same law; but then it happens always that the storm is thrown back towards the south before reaching the meridian of Paris, and that it traverses Spain and the Pyrenees to extend itself over the Mediterranean. The coloration is generally very strong when the storm traverses France and England; it is also produced when it passes very high in the north. It varies with the intensity of the atmospheric movement, and with the distance at which the centre of this movement passes.

Dr. Besigny laid on the table a copy of the researches made on ozone, read by M. Schönbein at one of the meetings of the Scientific Association of France, held at Metz. The following is an extract:—Ordinary oxygen is without action upon the protoxide of thallium, while ozonized oxygen combines rapidly with this oxide so as to form the peroxide of thallium, which is brown. Paper steeped in a solution of oxide of thallium and exposed to free air, would be an excellent ozonometric paper if the carbonic acid of the air did not transform the oxide into carbonate, which passes more slowly to the state of peroxide, and blackens with difficulty under circumstances where strips of paper, iodized and starched, become coloured at the end of a few minutes in an atmosphere which contains a 1-2,000,000th part of ozone. The comparison between the two papers has at least the advantage of proving that the coloration of the iodized paper is really produced by the atmospheric ozone.

In an answer made by Mr. Faye to the objections urged, in April last, by M. Kirchhoff, against his theory of solar spots, he stated the question in the following terms:—"Admitting that the solar spots are simple 'daylights' (they are assuredly only cavities), in the luminous clouds which constitute the photosphere, to explain how it happens that we do not perceive through the cavity the whole body of the sun (150,000 leagues thick), the internal face of the photosphere on the opposite side of the celestial body in all its brightness." Again taking up the discussion, M. Faye calculates the trajectory of the luminous ray starting from that portion of the photosphere opposite to the eye which regards the spot, and thinks that he can prove by a very simple analysis, by supposing the obscure mass of the sun to be perfectly transparent, this portion of the photosphere would remain invisible. The reason of this is that the luminous ray would describe a spiral curve without ever coming out. Examining, then, the English theories, which pretend to explain the spots on the sun by its atmosphere, the influence or position of the planets, the intervention of cometary or meteoric matter, he demonstrated that these three causes are totally insufficient and inadmissible, inasmuch as they imply the existence round the sun of an atmosphere the thickness of which is one-third of the solar radius.

M. Blanchard presented a note from M. Targioni Tozzetti, professor at Florence, on the wax produced by the fig cochineal (*coccus coccineus*), which contains half its weight of ceroline, and can be abundantly procured and used in the industrial arts.

M. Blanchard also presented a note on the moulting of fishes, by M. Baudelot. Tubercles are often observed on the skin of fishes, accompanied by the falling off of the scales; these were sometimes considered as characteristic of a new species of fish. M. Baudelot has found that they are periodical, and are to be found in certain seasons of the year, thus constituting a true moulting.

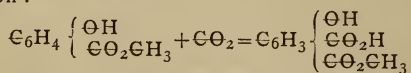
CHEMICAL NOTICES FROM FOREIGN SOURCES.

Oenanthylidene and Caprylidene.—E. Rubien. Oenanthylidene, C_7H_{12} , is prepared by heating oenanthylidene chloride with twice its volume of a strong alcoholic solution of potassic hydrate, first under ordinary pressure, and afterwards in sealed tubes to 150° , repeating the treatment again and again, until the greater part of the oil, which separates on addition of water, distils below 120° . From this portion the pure oenanthylidene is obtained after repeated fractional distillations, boiling at $106^\circ\text{--}108^\circ$. It is a colorless, thin liquid, lighter than water, rapidly volatilising at ordinary temperature, burning with a luminous flame, and dissolving in ether, alcohol and benzol. Bromine gives rise to two substitution-compounds— $\text{C}_7\text{H}_{12}\text{Br}_2$ and $\text{C}_7\text{H}_{10}\text{Br}_4$, the latter only having been obtained pure. Caprylidene, C_8H_{14} is obtained from caprylenic bromide by the same process, the reaction taking place somewhat more readily. Bromine produces the compound $\text{C}_8\text{H}_{14}\text{Br}_4$, which on being treated with alcoholic potassic hydrate is converted into $\text{C}_8\text{H}_{11}\text{Br}$.—(*Ann. Chem. Pharm.* cxlii. 294.)

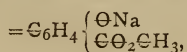
Trichlordracrylic acid.—P. Janasch. A boiling mixture of potassic bichromate and diluted sulphuric acid (1 acid to 1 water) converts the solid trichlorotoluol (fusing at $75^\circ\text{--}76^\circ$) into trichlordracrylic acid, $\text{C}_7\text{H}_3\text{Cl}_3\text{O}_2$. The acid melts at 160° , is readily soluble in alcohol and ether, sparingly so in hot, almost insoluble in cold water. The baric salt crystallises in long needles, and has the composition $(\text{C}_7\text{H}_4\text{Cl}_3\text{O}_2)_2\text{Ba}$.—(*Ann. Chem. Pharm.* cxlii. 301.)

Trixylylamine.—P. Janasch. This body is formed when chlorxylol (boiling at 200°) is heated with alcoholic ammonia in sealed tubes to 100° . For its separation, the alcohol has to be boiled off, and ammoniac chloride removed by washing with water; the remaining oil is then treated with chlorhydric acid, and extracted with ether, the latter dissolving an oily body of, as yet, unknown nature. Trixylylaminic chlorhydrate is insoluble in ether or water, but soluble in alcohol, fuses at $203^\circ\text{--}204^\circ$, and has the formula $(\text{C}_8\text{H}_9)_3\text{N}, \text{HCl}$. Sodid hydrate precipitates the free base, trixylylamine, as a thick oil, heavier than water, not solidifying at -15° .—(*Ann. Chem. Pharm.* cxlii. 303.)

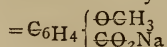
Methylsalicylic acid, formation of.—C. Graebe. The similarity in the behaviour of the hydroxyl-group in phenol and in gaultheria-oil led to the belief that analogous to the synthesis of salicylic acid (Kolbe and Lautemann) oxyphthalic acid might be obtained by acting upon gaultheria-oil with sodium and carbonic anhydride, the reaction might be expected to proceed according to the equation:



No acid of the composition of oxyphthalic acid, however, was formed, but salicylic and methylsalicylic acid instead. As carbonic anhydride does not take any part in the reaction, the effect of sodium alone on methyl salicylate had been tried, and it was found that at ordinary temperature the methyl ether of sodiosalicylic acid



and at $200^\circ\text{--}220^\circ$ sodic methylsalicylate

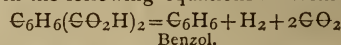


besides a small quantity of methyl salicylate and sodic salicylate is formed.—(*Ann. Chem. Pharm.* cxlii. 327.)

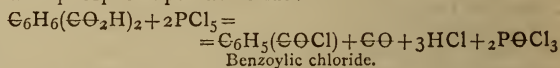
Hydrophthalic Acid.—C. Graebe and O. Born. Benzol, although a saturated compound, is capable of uniting with

two, four, or six monovalent elements, or groups of elements, thus forming the so-called products of addition of the aromatic series which possess the common property of being more or less easily reconverted into compounds of the benzol type. None of these bodies, however, with the exception of quinic acid (*Ann. Chem. Pharm.* cxxxviii. 197), have been sufficiently studied to afford a clear insight into their constitution. The present contribution contains the results of the author's researches on the addition of hydrogen to phthalic acid.

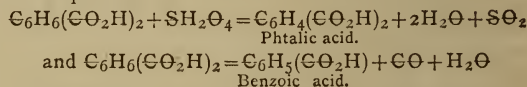
Hydrophthalic acid is prepared by adding sodium-amalgam to a solution of 1 part of phthalic acid, 1 of crystallised sodic carbonate, and 8 of water; the acid is then precipitated with chlorhydric acid, recrystallised and decolourised by means of animal charcoal. It is sparingly soluble in cold water and ether, more readily in alcohol and hot water; it may be heated to 200° without decomposition; being a bibasic acid, it forms neutral and acid salts, several of which are described. The decomposition which hydrophthalic acid undergoes with various reagents are shown in the following equations:—With soda-lime:



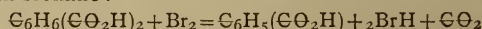
with phosphoric pentachloride:



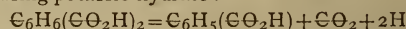
with sulphuric acid:



with bromine:



with fusing potassic hydrate:



with nitric acid, or potassic bichromate and sulphuric acid, benzoic acid is principally formed. Heated by itself to above 200° hydrophthalic anhydride is obtained. Chlorhydric acid acting upon an alcoholic solution of hydrophthalic acid does not produce the ether of the latter, but benzoic ethide.—(*Ann. Chem. Pharm.* cxlii. 330.)

Thallic Acid.—According to E. Carstanjen, thallic acid is formed when a current of chlorine passes through a hot solution of potassic hydrate containing thallic oxide in suspension, the liquid at the same time assuming a crimson colour. The solution may be evaporated and even filtered through paper, without undergoing decomposition; acids decompose the new compound, setting free oxygen. Further details are promised.—(*Fourn. Prakt. Chem.* ci. 55).

Molybdates.—F. Ulik finds that there are six series of molybdates, corresponding to the general formulæ:—

- | | |
|---|---|
| 1. $\text{MO}, \text{MoO}_3 + n\text{HO}$ | 4. $\text{MO}_3, \text{MoO}_3 + n\text{HO}$ |
| 2. $\text{MO}_2, 2\text{MoO}_3$ | 5. $\text{MO}_4, \text{MoO}_3 + n\text{HO}$ |
| 3. $3\text{MO}, 7\text{MoO}_3 + n\text{HO}$ | 6. $\text{MO}_8, \text{MoO}_3 + n\text{HO}$ |

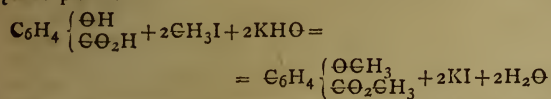
Those hitherto known belong to series 1, 3, and 4. The salts of the 4th and 5th series appear in two modifications, a crystalline and an amorphous.

It is further shown that a decided analogy exists between molybdic, chromic, and sulphuric acid, the first forming a magnesian salt analogous in composition to the corresponding sulphate; and in the double salt $\text{KO}, \text{MgO}, 2\text{MoO}_3$, one half of the molybdic acid may be replaced by chromic acid.—(*Fourn. Prakt. Chem.* ci. 61).

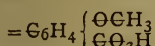
Methoxybenzoic Acid.—C. Graebe and O. Schultzen. It has been shown (*Ann. Chem. Pharm.* cxxxix. 134) that the body obtained by acting upon gaultheria-oil with potassic hydrate is potasso-salicylic methide, and that the latter may be converted into methylesalicylic acid; it has likewise been proved that paraoxybenzoic acid, by the same reaction gives rise to the formation of sodioparaoxybenzoic ethide and anisic acid. The object of the present

communication is to show that oxybenzoic acid, as regards the derivatives mentioned, behaves like its two isomers.

Oxybenzoic acid, prepared with unimportant modifications according to Fischer's method (*Ann. Chem. Pharm.* cxxxvii. 137), is heated together with potassic hydrate and methylic iodide in sealed tubes, to 140°, when the following reaction takes place:—



The methoxybenzoic methide thus formed is treated with potassic hydrate, and thereby converted into methoxybenzoic acid



The acid is readily soluble in hot water, from which it crystallises in long white needles; it is also soluble in alcohol and ether; it fuses at 95°, and sublimes without decomposition. The argentic salt = $\text{C}_6\text{H}_7\text{AgO}_3$ is obtained as a white precipitate, soluble in hot water. —(*Ann. Chem. Pharm.* cxlii. 350.)

NOTICES OF BOOKS.

Elements of Chemistry, Theoretical and Practical. By WILLIAM ALLEN MILLER, M.D., LL.D., Treasurer and Vice-President of the Royal Society, Vice-President of the Chemical Society, Professor of Chemistry in King's College, London, &c., &c. Part I., Chemical Physics. 4th Edition, with additions. 1867. (Longmans).

For the last dozen years Professor Miller's book has been the most important of English manuals of chemistry. Smaller and cheaper works have indeed very frequently supplied its place to the beginner and the non-professional student; and the advanced chemist has been constantly compelled to resort to the elaborate, though somewhat inconvenient, handbook of Gmelin. But for ordinary use by the advanced student, the manufacturer, the general reader, and the professional chemist, "Miller" has been the almost invariable guide. It is looked upon by most English chemist with a kindly regard, derived partly from familiarity, but even more from gratitude. No one can estimate the importance to the progress and spread of a science, of a well-written, lucid, and comprehensive manual. Sciences which are not so provided are sure to languish, if not in development, at any rate in popular estimation and general cultivation.

Very peculiar qualifications are necessary for the successful compilation of such a manual. The author must be a man of original genius as well as of deep and varied knowledge. He must be unprejudiced and tolerant in his judgment, able to see the fragmentary truth in two contending views, and able, also, to sift contending evidence—the amount of which is unfortunately always immense,—and, without dogmatism, to note the probabilities to which it points. And, finally, to render his labours of much avail, he must be a man of mark in his science—one whose researches and experience are sufficient to stamp his opinions with some authority. It is not good that he should be too closely bound to any one of the fleeting systems of science. He must be an exponent, not an advocate, using new theories and crude, half-proven facts with the cautious hand of one who knows how soon they may be swept away. His duty it is to write,

"Not clinging to some ancient saw;
Not mastered by some modern term;
Not swift, nor slow to change, but firm
And in its season bring the law
That from Discussion's lip may fall—"

surrendering the most cherished of his convictions, the most habitual of his modes of expression, the moment the growing mass of scientific fact shall point it out as desirable.

It is unnecessary to point out how well Professor Miller fulfils these hard conditions. There is probably no chemist in England less dogmatic in his tone of thought, or less wedded to any particular system. The present edition of his "Manual" affords, we are happy to say, a most convincing proof of this, if any proof were still wanting. Just at the juncture when the interests of chemistry required it, when the revolution which began with the petty insurrection of $\Theta = 16$ against $\text{O} = 8$, is completing itself, and when something like consistency is once more apparent in the language of chemical journals, this new edition appears, and we find that the author, instead of endeavouring to patch up an effete doctrine, has given in his adhesion to the new, and formally ranged himself under its banners.

Every chemist knows the book so well that it would be absurd to offer more than a few passing comments upon it. The present volume, occupied almost entirely with physics, is but little changed by the alteration in nomenclature and notation. The introductory chapter has been chiefly re-written, and although the author, with characteristic caution, stops short of the extreme development of the most modern theorists, his sketch of the laws which govern the operations of chemical force is perfectly in accordance with modern doctrine, while it preserves the admirable lucidity which distinguished previous editions. As in Hofmann's little book, the term "equivalence" is used instead of "atomicity," which is decidedly barbarous, and is, moreover, open to the charge of implying more than can be proved.

The general plan of the volume has been but little altered, though a good many additions have been made to it. The section on the photographic action, of light has, very wisely, been transferred from the second volume, and is a most valuable summary of the present state of knowledge upon the subject. Spectrum analysis is, of course, enlarged, and is prefaced by a useful sketch of the history of the subject. The recent researches of Dale and Gladstone, and of Landolt, upon the connection of optical properties with chemical composition, are shortly described. The wonderful results of Graham on the absorption of gases by metals have been inserted, although his last extraordinary experiment, in which hydrogen was separated from a meteorite, was not announced until the volume was in print. In the chapter on electricity we find clear descriptions of the magneto-electrical machines of Holmes and Wilde, although the curious electrical machine of Holtz is unaccountably omitted. The conclusions of the British Association committee on the standard of electrical resistance have been inserted in some detail, well warranted by their extreme importance.

The above are, we believe, the most important of the additions which distinguish this edition. Of course there are a few omissions to notice: it would be a strange thing if there were not in a work upon so wide a plan. We regret the absence of Stokes's beautiful and simple methods for the spectroscopic examination of liquids, and their extensions by Sorby, though perhaps the latter belongs more properly to microscopy. And, to select another illustration, it would surely have been well to have given some account of Balfour Stewart's striking experiment on the rotation of a disc *in vacuo*, for although its present explanation must still be regarded as hypothetical, it is in the highest degree suggestive. These, and a few more of the same kind, are, however, but specks in a most excellent work, and we cannot conclude without congratulating the author on the care and skill with which he has moulded the successive editions of his book into harmony with the rapid strides of science.

CORRESPONDENCE.

COMMERCIAL ANALYSES.

To the Editor of the Chemical News.

SIR,—Some months ago we heard a little on this matter in your columns. Are we always to be annoyed by these discrepancies? I have just incurred two fees to two separate chemists of large experience in analysing artificial manures, one "high" and the other "low." These two gentlemen have operated on portions of the same fairly drawn sample of superphosphate; the difference between them is only seven per cent! As a seller, of course I shall believe the "high" analyst, and when I am purchasing goods I shall, for as obvious a reason, employ the "low" man.—I am, &c.,

SIMON SIMPLE.

MISCELLANEOUS.

The Earliest Universal Exposition of which we have any record, was held at Rome, in the days of Nero. The philosopher and moralist, Seneca, gives the following account of it: "I was present, the other day, at a solemn exhibition of the wealth of Rome; where I saw statues which were marvels, perfect masterpieces; exquisite stuffs and draperies, and costumes brought from countries even beyond the Roman frontiers," etc.

Nitro-Glycerine in Blasting.—A correspondent of the Nevada Gazette, who has recently visited the summit tunnel on the Central Pacific Railroad, writes that the contractor thinks they are going ahead with the tunnel fully twenty-five per cent faster by the use of nitro-glycerine than they could by using powder. The small holes required for the oil can probably be drilled in less than one-third the time required for larger ones necessary in using powder. The oil does much more execution than powder, as it always breaks the rock from two to sixteen inches beyond the hole, and also throws out a much larger body. The oil, in hard rock, shows a strength five times greater than powder, pound for pound. It is made upon the spot, and is considered much stronger, as well as safer, than that imported. They have now been using it for several months, and have never yet had a premature explosion, or any other accident, and not a single blast has missed fire since the Chinamen commenced filling the cartridges. The work upon this road seems to have fully set at rest the superiority of nitro-glycerine over powder, both for economy and safety. Of course this applies to the oil made upon the spot, and not to the imported article.

Clarifying Action of Sulphate of Alumina on Turbid Water.—Whatever be the nature and quantity of the earthy substances held in suspension in turbid water, it becomes fit to drink in from seven to fifteen minutes if to each litre there be added .04 grammes of finely-powdered alum, care being taken to agitate the liquid when the alum is introduced (this is about $\frac{1}{4}$ lb. per ton of water). If potash alum is used the alum is decomposed into sulphate of potash, which is all dissolved by the water, and sulphate of alumina, which, by its decomposition, purifies the water. The alumina separates in an insoluble form, and carries down with it as it precipitates the matters which render the water troubled, and the organic matter. The acid attacks the alkaline and earthy carbonates, and transforms them into sulphates. The water becomes slightly richer in bicarbonates and free carbonic acid, whilst all organic matter is destroyed. Seven parts of sulphate of alumina will purify as much water as ten parts of rock alum or potash alum, and the sulphate of alumina does not introduce any alkaline sulphate into the clarified water.—*Technologiste*, vol. xxiv, p. 197.

What is Fame!—The following extract from an American scientific paper somewhat surprises us. The only explanation we can offer is, that the paragraph was possibly translated from the French. "Offers of knighthood have been made and refused by several of the distinguished mechanics and men of science in Great Britain. James Watt refused knighthood, as did Michael Faraday. The latter commenced life as a poor mechanic, and worked up to the head of his profession; is an honorary member of the Institute of France, Fellow of the Royal Society, an able author on engineering subjects, and is the inventor of the cellular hollow girder system, upon which the Britannia tubular bridge is built."

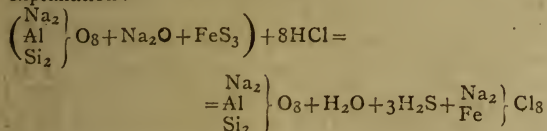
How to Produce Stoneless Fruit.—At a late meeting of the Agricultural Society in India, the Rev. Mr. Firminger communicated a plan by which the stones of fruit may be reduced or made to disappear, and the pulp increased in size and flavour. At any time during the cold season select a branch that is to be used afterwards for inarching. Split it up carefully somewhat less than a span long. From both halves of the branch thus split scoop out cleanly all the pith; then bring the split halves together again, and keep them bandaged till they have become thoroughly united. At the usual time, the beginning of the rains inarch the branch thus treated upon suitable stock, taking for the place of union the portion of the branch just below where the split was made. Upon a branch of the tree thus produced a similar operation is performed, and so on for successive seasons, the result being that the stone of the fruit becomes less and less after each successive operation. This process has been applied likewise to the grape vine at Malaga, and plants thereby have been produced which bear the finest fruit, without the slightest vestige of a stone within them.—*Mining Press*.

Explosion of Gun-cotton.—On Monday afternoon an explosion occurred in a building used for the purpose of drying gun-cotton at the works of Messrs. T. Prentice and Co., Stowmarket. The building was a two-storied one, the bottom being built of clay lumps, and the upper part of wood with a lining, the space being filled up with sawdust packing. The roof was of slate. The building was situated near the bank of the river on the railway side, at the further end of the works. The custom has been to place the manufactured cotton in the building moist, and to subject it for a time to heat varying from 90° to 120°. This heat was imparted by means of pipes from an adjacent shed, in which were a series of stacks of horizontal pipes generating heat from steam conveyed to them by a pipe across the river. About 3 p.m. a loud, dull report was heard, followed by another sharper report, and the building attacked was levelled with the ground, while the ruins were in a blaze. The flames spread to another drying shed, in which was a quantity of the sheets of paper used in cartridges, hung up for drying. The roof of this shed was blown up, and the flames thence extended to some large tanks containing cotton in process of manufacture. Some of the covers were burnt, but the cotton was only blackened in places. Some trees on the railway side of the works were burnt and scorched, and some cattle belonging to Mr. Arnold Scuttle were badly burnt. No person was in the shattered buildings when the explosion took place, although two men named Conham and Broom had been in the drying shed a few seconds before the accident happened. The occurrence is attributed to over heating; the sun made the roof very hot, and the pipes forcing in more hot air, the temperature was raised to 170°, at which gun-cotton explodes.—*The Times*.

[If 170° refers to Fahrenheit's scale it is entirely wrong. Professor Abel places the exploding point of gun-cotton at about 150° C., which is equivalent to 302°F.—Ed. C.N.]

Legalised Poisoning.—It is high time that steps were taken to compel the Metropolitan Railway Company to supply their passengers with air which can be inhaled without danger to life. Travelling daily along that line, we have noticed for some months past that the atmosphere, especially between Baker Street and King's Cross, has been getting more and more foul, until at the present time it is almost unbearable. Sulphurous acid is almost habitually present in such quantities as to render breathing painful, and to induce a feeling of suffocation. That these statements are not exaggerated is proved by the shocking death which actually took place at one of these stations one day last week. The inquest was held by Dr. Lankester. The deceased, Sarah Dobner, whilst at the station complained of great difficulty of breathing, and said she was in great pain. A medical man advised her removal to the hospital, but it was then believed she was dead. Mr. Anderson, one of the surgeons at St. Mary's Hospital, who made the *post mortem* examination, said the deceased was labouring under disease of the bronchial gland, and undoubtedly the suffocating air of the Underground Railway had accelerated death. The coroner said he had experienced the depressing effect of that railway, and therefore avoided it as much as possible. The tunnels and stations should be ventilated, but he supposed that would not be done until some shocking loss of life from suffocation had occurred. The jury returned a verdict of "Death from natural causes, accelerated by the suffocating atmosphere of the Underground Railway." The Underground Railway is, however, not the only place where a neglect of the most ordinary dictates of common sense has occasioned loss of life. The *British Medical Journal* last week chronicled the poisoning of a young clerk by the bad atmosphere of a small telegraph-office room, ill ventilated, and with four gas-burners, of which "all the clerks had complained." This is only a rapid and compressed view of a tragedy constantly being worked out more slowly in work-rooms and offices, and approximately imitated by the poisoning and illness due to the bad ventilation of our gas-lit theatres, churches and ball-rooms.

Double Sesquichloride of Iron and Sodium.—I produced this combination, which as far as I know, is a new one, by the action of hydrochloric acid upon artificial ultramarine. The silicate becomes separated, and if water be added and the solution filtered, the double chloride in question, which is colourless, will be found in the filtrate. The following equation will serve as a further explanation:—



By writing upon paper with the solution and afterwards warming it, the letters become black, just as in the case of some sympathetic inks. As the writing does not disappear again by the action of water, it is to be supposed that sesquichloride of iron and sodium is decomposed by heat.—*J. Landauer.*

The Standard Pound.—It appears from the reports of the Comptroller-General of the Exchequer that the Exchequer standard avoirdupois pound is actually at the present time in a most unsatisfactory condition, "oxidated on the surface, practically erroneous on the face of it, and known to be erroneous;" and as all the Exchequer standard weights are made of brass, a metal stated to be peculiarly liable to oxidation in the atmosphere of London, and described by Professor Miller as "quite unfit, unless well protected by gilding, to be used in the construction of weights having that degree of accuracy which is required in secondary standard," it is to be feared that others of these Exchequer standard weights may be wanting in accuracy.

Petroleum as Fuel.—The idea of employing petroleum as a substitute for coal in the generation of steam has for some time engaged the attention of scientific men in America, and recently, under the auspices of the Navy Department, a series of experiments on the subject has been carried on at Boston, and there seems a fair prospect that the investigations will result successfully. A gunboat called the *Palos* was used for the experiments. She had been built for the Government, to make a speed of eight knots an hour, and with coal could never be forced beyond that. First she was tied to the dock, and the possibility of getting up steam with petroleum was demonstrated. She was then sent on a trial trip down the harbour. Steam was got up with petroleum in 25 minutes, and the *Palos* steamed down the harbour and back, a distance of 25 nautical miles, in 1 hour and 55 minutes. In making this trip she consumed but four barrels of petroleum. The fires are reported to be kindled and extinguished with nearly the same ease as lighting and extinguishing a gas-burner. The furnaces of the *Palos*, originally built for burning coal, were fitted at comparatively small expense with burners to which the petroleum was led by pipes from the tanks on deck. The burners, by their own heat, turn the petroleum in the pipes into gas, and in this form it is burnt. The flames produced are intensely hot, and the petroleum burnt on the trip produced as much steam as 20 times its bulk in coals—a great saving of room in ocean voyages. The dangerous properties of the petroleum appear to be the only drawback to its use in this way, for coal-burning furnaces can be adapted to its use at but a trifling expense. The supply of petroleum is now so much greater than the demand that, even with three-fourths of the wells in the producing regions abandoned, it can be bought for 2d. a gallon. Its cheapness is therefore another strong inducement to use it for generating steam.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the *CHEMICAL NEWS*.]

Annales de Chimie et de Physique. April, 1867.

C. MARNAG, "On some Fluates of Antimony and Arsenic." WYRUBOFF, "On the Optical Properties of some new Tartrates." F. ROSSETTI, "On the Maximum Density and on the Expansion of Distilled Water."

Bulletin de la Société d'Encouragement. March, 1867.

PUSCHER, "On a new Gold-coloured Lacquer for Brass Articles." "On the Extraction of Copper by Hydrochloric Acid as used at Braubach (Nassau)."

Annales du Génie Civil. May, 1867.

L. DROUX, "On the Providencia Soap and Candle Works in San Sebastien, in Spain." N. BASSETT, "On G. Ville's Improved Artificial Manure." PAQUOT, "On the Use of Chloride of Barium for preventing the Formation of Boiler Scale." LIBERT, "On the Use of Catechu for preventing the Formation of Boiler Scale." TASKIN, "On the Prevention of Boiler Scale." A. SOUHEUR, "A new Petroleum Safety Lamp for Mines." "On the Use of naturally-formed Gas for Illuminating Purposes."

Dingler's Polytechnisches Journal. April, 1867.

C. SCHIZ, "On Lindner's Regenerative Gas Furnace." "On Regenerative Gas Furnaces as applied to the Manufacture of Glass." "On Lindner's Theory Respecting the Influence of the Form of Fuel on Combustion." L. KAMPHOR, "On the Production of Gas from some of the Waste Products of the Manufacture of Cresote." E. SOSTMANN, "On the Use of Paraffin in the Manufacture of Sugar." J. VON LIEBIG, "On the Diseases of Silkworms." NESTLER, "On MacDougall's Disinfecting Powder for Stables."

April 13, 1867.

"On a Method of renovating Tiles by etching with Sulphuric Acid." A. PATERA, "On the Electrolytic Precipitation of Copper from its Solutions." C. AUDEL, "On a new Method of Extracting Copper from slags by means of dilute Sulphuric Acid." E. BRIMEYER, "On the different Processes for utilising the Refuse of the Fuchine Manufacture, and for reobtaining the Arsenic Acid." L. WALKHOFF, "On Dubunfaut's Method of obtaining Sugar from Molasses by Dialysis." J. C. LERNER, "On the Alkaloid of Beer."

SUPPLEMENT

TO THE

CHEMICAL NEWS.

VOL. XVI., No. 402.

TECHNICAL EDUCATION.

THE subject of Technical Education has recently attracted attention in this country, owing to the evidence considered to be afforded by the International Exhibition at Paris, of the inferior rate of progress recently made in manufacturing and mechanical industry in England compared with that made in other European countries. It has been stated that this alleged inferiority is due in a great measure to the want of technical education, and steps have, therefore, been taken to ascertain from many eminent English jurors whether they agree with this opinion.

We have been favoured with an early copy of the correspondence which has taken place on this subject, and we think we shall be doing good service to the cause of education by laying an abstract of some of the letters before the readers of the *CHEMICAL NEWS*. The inquiry originated in a letter from Dr. Lyon Playfair to Lord Taunton, Chairman of the Schools Inquiry Commission. In it he states that, with very few exceptions, a singular accordance of opinion prevails that our country has shown little inventiveness, and made but little progress in the peaceful arts of industry since 1862. When he found some of our chief mechanical and civil engineers lamenting the want of progress in their industries, and pointing to the wonderful advances which other nations are making; when he found our chemical, and even textile, manufacturers uttering similar complaints, he naturally devoted attention to elicit their views as to the causes. So far as could be gathered by conversation, the one cause upon which there was most unanimity of conviction was that France, Prussia, Austria, Belgium, and Switzerland possess good systems of industrial education for the masters and managers of factories and workshops, and that England possesses none. A second cause was also generally, though not so universally admitted, that we had suffered from the want of cordiality between the employers of labour and workmen, engendered by the numerous strikes, and more particularly by that rule of many trades' unions, that men shall work upon an average ability, without giving free scope to the skill and ability which they may individually possess. Dumas asserts that technical education had given a great impulse to the industry of France. In going through the Exhibition, whenever anything excellent in French manufacture struck his attention, his invariable question was, "Was the manager of this establishment a pupil of the *Ecole Centrale des Arts et Manufactures*?" and in the great majority of cases he received a reply in the affirmative. General Morin, so well known as the director of the *Conservatoire des Arts et Metiers*, has lately sat on a commission to examine into the state of technical education in other countries, and to extend it in France, and their recommendations are likely to be promptly and largely acted upon. General Morin was of opinion that the best system for the technical education of *workmen* is to be found in Austria, though the higher instruction of masters and managers is better illustrated in France, Prussia, and Switzerland.

In 1853 Dr. Playfair published a little work on "Industrial Education on the Continent," in which he pointed out that as an inevitable result of the attention given to it abroad, and its neglect in England, other nations must advance in industry at a much greater rate than our own country. It is feared that this result is already attained for many of our staple industries, and the writer concludes his eloquently written letter by urging upon the Government to hold an

official inquiry on this subject, and tell the people of England authoritatively what are the means by which the great States are attaining an intellectual pre-eminence among the industrial classes, and how they are making this to bear on the rapid progress of their national industries.

This letter was considered so important that copies of it were sent to a great number of eminent English jurors, with a request that they would communicate their views on the subject.

We extract from the numerous answers the following opinions, which more particularly bear on chemical and physical education:—

PROFESSOR TYNDALL, F.R.S., expresses a general concurrence in the views of Dr. Playfair. The facilities for scientific education are far greater on the Continent than in England, and where such differences exist, England is sure to fall behind as regards those industries into which the scientific element enters.

He has long entertained the opinion, that in virtue of the better education provided by continental nations, England must one day—and that no distant one—find herself outstripped by those nations, both in the arts of peace and war. As sure as knowledge is power this must be the result.

DR. FRANKLAND, F.R.S., says that Dr. Playfair's communication substantially expresses his own convictions in regard to the matters therein mentioned. As a juror in class 44 of the present Paris Exhibition, he was not only forcibly struck by the want of evidence of progress in the different branches of chemical manufactures carried on in Great Britain, but still more so at the great advances made by other nations, more especially by Germany, France, and Switzerland, in respect of such manufactures since the year 1862, when, as a juror in the corresponding class, he had also an opportunity of comparing the chemical manufactures of different nations. He refers this want of progress in the manufactures of this country chiefly to the almost utter lack of a good preparatory education for those destined to take part in industrial pursuits. This great defect in the school and college education of England affects the masters and managers of our factories even more deeply than the workmen themselves. The former have but rarely had any opportunities of making themselves acquainted with the fundamental laws and principles of physics and chemistry; they therefore find themselves engaged in pursuits for which their previous education has afforded them no preparation, and hence their inability to originate inventions and improvements. It is true that such men not unfrequently imagine themselves inventors, and the yearly files of patent specifications abound with instances of their so-called inventions. The great loss of time and money attending these futile patents would be rendered impossible by a very moderate, if accurate, knowledge of chemical and physical science.

In the polytechnic schools of Germany and Switzerland the future manufacturer or manager is made familiar with those laws and applications of the great natural forces which must always form the basis of every intelligent and progressive industry. It seems that at length this superiority in previous training is more than counterbalancing the undoubted advantages which this country possesses in raw material.

DR. DAVID S. PRICE considers that as far as relates to chemical products, the exhibition made by Great Britain is a "deficient representation," and will not enable foreigners to form a correct estimate of the nature and extent of chemical manufactures now carried on in this country; what is shown in class 44 is, as a rule, injudiciously exhibited, contrasting painfully with the taste and spirit evinced by the French in their arrangements in the same class.

The writer's conviction is that it is most important that these international competitions should not be allowed to degenerate into a means for advertising, and that it behoves those who are intrusted with their organisation

to see that the several departments of industry are intrusted to men who take an active interest in them, and are thus a guarantee that every endeavour will be made to have them fairly and properly represented, which is not the case on the present occasion, so far at least as refers to classes 40 and 44.

He does not agree with Dr. Playfair that the technical education of working men is the most important method for the maintenance of our industrial supremacy. The information gleaned by acting upon his suggestion would be instructive, and great good would result from its application; but what is really wanted for this country, and is of vital consequence to our future prosperity, is a higher scientific culture of those who are likely, in the natural course of events, to be master manufacturers, so that when discoveries are made they may fructify and not stagnate or decay, as has too often been the case, for want of intelligence on the part of those who command capital and works to perceive their merits; and that they, the manufacturers, may be able to appreciate and adequately remunerate the scientific talent that this country is, and always will be, able to afford them. No reformation bearing upon industrial progress is more required than in the Legislature, and it is a reproach to the country that science is not represented in Parliament.

It would be well if an investigation were made as to what have been the results of the teachings in science of the German universities; what Liebig has done for modern chemistry, and how the system inaugurated by him at the small University of Giessen has spread throughout the world, and what benefits have resulted from it; what we owe to the teachings of other chemists, the physicists, metallurgists, and geologists of those excellent seats of learning. Whilst advocating the necessity for the dissemination of scientific training in England, Dr. Price does not omit to bestow a passing tribute of commendation to the success of those institutions of recent date which were established to supply a want that existed many years since;—the Royal College of Chemistry, of which the late Prince Consort was the President, the School of Mines, and the colleges in the metropolis where scientific departments have been founded. In the first named, many of the men who have taught, and not a few of those who have studied there, have not only enriched chemical science by their researches, but have left a permanent mark upon the leading industries of this country. From the School of Mines have emanated men who in metallurgy and geology have greatly extended the application of those sciences. It is, however, a well-known fact that the public do not rightly appreciate the education that this institution is capable of affording, and that comparatively but few of the sons of manufacturers avail themselves of its advantages.

The writer calls particular attention to a plan proposed by the eminent chemist, Frémy, that young chemists of talent, who are desirous of devoting their time to the advancement of science, and therefore for the benefit of mankind, should be liberally supported by the State. It is suggested that this excellent idea should be brought to the notice of the Chancellor of the University of London, who from his well-known zeal in the cause of education, and from his position, is better able than any one else to obtain the evidence of scientific men as to its value, and, if approved of, to secure its adoption in this country. The same principle might well be extended to the other departments of science which bear upon industrial progress.

The author's firm belief is that extended scientific education is of the highest consequence to us if we wish to retain our present position in the scale of nations; that it will mostly benefit the future master manufacturer, that it must tend to elevate the social position of the intelligent working man, and to create a greater sympathy

between master and man than at present prevails, and if it do this, the evils which threaten to impede, if not to paralyse our national progress, may be averted.

JAMES YOUNG, Chemical Works, Bathgate, feels bound to say that his experience accords with that of Dr. Lyon Playfair. So formidable did the rate of progress of other nations appear to many, that several meetings of jurors, exhibitors, and others took place at the Louvre Hotel on the subject. The universal impression at these meetings was that the rate of progress of foreign nations in the larger number of our staple industries was much greater than our own. But it must be stated that a large number of our first-class machine and other manufacturers are not exhibitors in Paris, whereas other nations, he believes, have taken care to bring forward their very best; still, the great progress of other countries is evident. The reason for this increased rate of progress is the excellent system of technical education given to the masters of workshops, sub-managers, foremen, and even workmen.

England for a long time excelled all other countries in the finish of her machines; but now we find that foreign machine makers are rapidly approaching us in finish, and, having skilled and intelligent labour cheaper than ourselves, are progressing in all the elements of manufacturing.

The writer uses his own case as an illustration. Originally he was a working man, but he has succeeded in increasing the range of manufacturing industry. The foundation of his success consisted in his having been fortunately attached to the laboratory of the Andersonian University in Glasgow, when he learned chemistry under Graham, and natural philosophy and other subjects under the respective professors. This knowledge gave him the power of improving the chemical manufactures into which he afterwards passed as a servant, and ultimately led to his being the founder of a new branch of industry, and owner of the largest chemical manufacturing works of the kingdom. It would be most ungrateful of him if he did not recognize the importance of scientific and technical education in improving and advancing manufactures. Many men without such education have made inventions and improvements, but they have struggled against enormous difficulties, which only a powerful genius could overcome, and they have been sensible of the obstacles to their progress. Stephenson, who so greatly improved locomotives, had to be his own instructor, but he sent his son Robert to Edinburgh University, and the son did works at least as great as the father, and with far less difficulty to himself.

The improvement in locomotion has necessarily created great competition in the industries of the world; and unless we add skilled instruction to manual labour, England cannot expect to maintain her position in the industrial race.

Red Lead, according to Barton, may be produced by heating oxide of lead to redness with nitrate of soda, or, by heating at the same temperature a mixture of 1,894 parts of sulphate of lead, 665 parts of carbonate of soda, and 177 parts of nitrate of soda. The resulting mass is to be washed.—*Bergeist*, No. 50.

The Queen's English at Paris.—The following is a literal copy of a handbill which has been extensively circulated in the Exhibition by a Spanish firm: "Blacking, oily and resinous, titled the emperor of the blackings black ink and of allcolours to write with of D. J. G. . . . member of the national academy of Great Britain. This Blackings is knoconed to be the most useful for the conservation of the shes, for its brilliancy, solidity, and complete discomposition of the black animal. Mr. J. G. dus a present of £20 sterling to the person that will present hum a blacking in paste, that will reunite the same conditions, as the Emperor of the Blackings."

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

(Continued from page 56).

Aniline Reds,

called *fuchsine*, *rosine*, *azaleine*, *rosaniline*, *Magenta*, *Solferino*, and other fanciful names, are conspicuous in the American section of the Paris Exhibition of this year. This colour was obtained by Dr. Hofmann as far back as the year 1843, when he was experimenting on aniline with fuming nitric acid; and 15 years latter (in 1858) he again obtained it, when he was studying the reactions of bichloride of carbon on aniline. He found, indeed, that when 3 parts of aniline were heated with one part of bichloride of carbon for some time, a resinous mass was produced which furnished to alcohol a rich crimson colour. This was aniline red; but, as he was studying the reactions for other purposes than the formation of coloured products, he merely noticed the fact, and put it upon record. A year after Messrs. Verguin and Rénaud Brothers, of Lyons, discovered and patented their process for making *fuchsine*, or aniline red, from aniline, by means of bichloride of tin; and thus a practical value was given to the scientific researches of Dr. Hofmann. *Fuchsine* is obtained by heating together 10 parts of aniline and 6 of anhydrous bichloride of tin in a glazed iron vessel for 15 or 20 minutes. The temperature should be about that of the boiling-point of the mixture (392° Fahr.). At first the mixture becomes yellow, then gradually more and more red, until the liquid mass looks black. When this occurs it is allowed to cool, and the mass is treated with a large quantity of boiling water, which acquires a rich crimson colour. This is the dye, and it may be used at once, or purified by adding to it a quantity of common salt, in which solution the dye is insoluble. The precipitated colouring matter is allowed to subside, and, after being collected upon a filter, it is dissolved in spirit, or acetic acid, and so forms the red dye. The process patented by Mr. David Price, in the year following (1859), was to act upon a solution of sulphate of aniline with peroxide of lead, by boiling them together in the proportion of one equivalent of the former to two of the latter, until the solution acquires a deep red colour. This is filtered; and, after being concentrated by evaporation, it is again filtered, to separate a resinous substance which forms in it. An alkali is then added to neutralize the acid, and the colouring matter is precipitated as a dirty brown powder. When this is collected upon a filter, washed with water, and dissolved in spirit or acetic acid, it forms a beautiful red dye, which is fit for use. Messrs. Simpson, Maule, and Nicholson, used this process very largely until the beginning of the year 1860, when Dr. Medlock committed to them his patent for making aniline red by means of arsenic acid. The process now followed is to mix together a highly concentrated solution of arsenic acid with aniline, using the latter a little in excess; a good proportion is 20 parts by weight of syrupy arsenic acid, containing 76 per cent of the solid acid, and 12 of commercial aniline. In this manner a pasty mass of arseniate of aniline is formed, and, when this is heated for some time at a temperature of about 300° Fahr., it intumesces, and at last forms a dark-coloured liquid, which, on cooling, sets into a resinous solid, with a bronze-like lustre. The crude colouring matter thus obtained is very soluble in spirit or water, and may be at once used for dyeing purposes, but it is better to purify it by adding a slight excess of slaked lime to the aqueous solution, and so precipitating the colouring matter with the insoluble arsenical salts of lime. The mixed precipitates are collected upon a filter, and the

colouring matter dissolved out with acetic or tartaric acid. Another and better method of purification is to dissolve the crude mass in dilute muriatic acid; then to filter, and to precipitate by adding a slight excess of alkali (carbonate of soda). The colour thus set free is to be collected upon a filter, washed with water, and then dissolved in spirit and acetic acid.

Another variety of aniline red, the nitrate of rosaniline, or *azaleine*, has been extensively manufactured in England by the process of Mr. Perkin, and in France by that of M. Gerber Keller. Mr. Perkin heats a mixture of aniline, or its homologues, with dry pernitrate of mercury for some time, at a temperature of 347° Fahr. The mixture first becomes brown, and then gradually acquires a dark crimson colour, during which time the mercury is reduced, and settles to the bottom of the fused mixture. On pouring it off, and allowing it to cool, it forms a solid mass of impure nitrate of rosaniline, which may be purified by dissolving in water, and precipitating with common salt. M. Gerber Keller's process is nearly similar, except that he uses a lower temperature. He takes 10 parts of aniline, and 7 or 8 parts of dry pernitrate of mercury, and heats the mixture for several hours in a bath of boiling water. Messrs. Dale and Caro obtain the colour by heating a mixture of equal parts of aniline and powdered nitrate of lead, and then adding little by little a fourth part of anhydrous phosphoric acid. Other processes have also been patented, as that of Lauth and Depouilly (1860), with nitric acid; that of Smith (1860), with perchloride of antimony, antimonious acid, peroxide of bismuth, stannic, ferric, mercuric, and cupric oxides; and Gerber Keller has claimed almost every common metallic salt that is known. As might be expected, a number of these processes are practically useless, and have been claimed for no other purpose than that of anticipating the profits of future discoveries.

Aniline Blues,

called *azaline*, *Bleu de Paris*, *Bleu de Lyons*, *Bleu de Mulhouse*, &c. Soon after the discovery of aniline red, it was observed that certain reducing agents had the property when heated with it of changing its colour to a purple or blue. Mr. Charles Lauth, for example, in 1860, described the blue colour which was obtained from *azaleine* (nitrate of rosaniline) by means of protochloride of tin, aldehyde, the natural essences, &c.; and M. Kopp demonstrated that the same colour was produced from aniline red by means of wood spirit. But as none of these colours were permanent, they were disregarded. In 1861 MM. Girard and De Laire procured their imperial purple in the manner already mentioned, by heating equal weights of aniline and dry muriate of rosaniline, at a temperature of about 350° Fahr., for several hours. If the purple is wanted, the mass is merely treated with dilute muriatic acid until it loses its excess of aniline and aniline red, but if a pure blue is required, the acid treatment is continued until all the red tint is removed, and a pure blue remains. This is finally dissolved in acetic acid, or methylated spirit, and the blue dye, called *Bleu de Lyons*, is obtained. The same blue, but called *Bleu de Paris*, was procured by MM. Persoz, De Luynes, and Salvétat, by heating a mixture of aniline and dry bichloride of mercury in a sealed tube for 30 hours, at a temperature of 356° Fahr. The mass when cold is dissolved in boiling water, and the colour precipitated by means of common salt. This operation is repeated until the blue is quite free from the green pigment which accompanies it.

A blue, called *Bleu de Mulhouse*, may be obtained by the process patented by MM. Gros-Renaud and Schaeffer in 1861, and which consists in boiling a solution of *azaleine* (nitrate of rosaniline) with gum lac and carbonate of soda for some time; and another blue, named *azuline*, has been produced by M. Marnas by a like treatment of a substance called *peonine*, with eight times its weight of aniline; and the residuum is purified with a succession of solvents, as water acidulated with muriatic or sulphuric acid, then

hot naphtha, then caustic alkali, and finally with water acidulated with muriatic acid. The azulene, or blue colour, which remains, is soluble in spirit and forms a rich blue dye. Blues are also produced by the action of numerous oxidizing agents on aniline or its salts, as by a solution of hypochlorous acid (Hofmann), by a solution of chlorate of potash and muriatic acid (Fritzsche), by peroxide of hydrogen (Lauth), by perchloride of iron or red prussiate of potash (Kopp), by peroxide of manganese or pernitrate of iron and hydrochloric acid (Scheurer-Kestner), by bichromate of potash and acid (Willm), and I have obtained it by oxidising the sulphate of aniline by means of the oxygen disengaged at the positive pole of a battery. In all these cases the blue is very difficult of solution, for it resists the action of every solvent but strong sulphuric acid. Taking advantage of this, Mr. Nicholson, in 1862, patented a process for purifying the blue colouring matter, by dissolving it in concentrated sulphuric acid, and then heating it for half an hour at a temperature of 302° Fahr. By diluting it with water it is precipitated in a modified condition, for it is now soluble in pure water. Dr. Hofmann ascertained that it was a substitution compound of rosaniline, in which three equivalents of hydrogen had been substituted by three equivalents of a hydrocarbon called phenyl ($C_{12}H_5$); he therefore named it tryphenylic-rosaniline, and this suggested the possibility of substituting other hydrocarbons, as methyl (C_2H_3), ethyl (C_4H_5), amyl ($C_{10}H_{11}$), &c., in which he was successful by acting upon rosaniline with the iodides of these radicals, and thus producing ethylic, methylic, and amylic substitution compounds of a rich blue and purple colour, called Hofmann's blues. Very recently the change has been effected by a more direct process without the aid of the iodide, but by heating a mixture of aniline, muriatic acid, and methylic alcohol under pressure, and then treating with iodine and chlorate of potash, or other oxidizing agent.

Aniline Greens.

Most of the blue substances just described become green by the action of acids, and again acquire a blue colour when they are washed or treated with alkalies. It has also been noticed that in certain states of oxidation, aniline acquires a green tint; but all attempts to utilize this colour failed until, in 1860, Messrs. Calvert, Clift, and Lowe patented the process for producing it upon the fabric. Their process was to prepare the fabric with chlorate of potash, and then to print upon it with acid muriate of aniline. In a few hours a beautiful bright green colour, called *emeraldine*, gradually appeared, and it was fixed by merely washing it with water. If a blue tint were required, the fabric was passed through a solution of bichromate of potash, when the oxidation of the aniline was carried still further, and a dark indigo blue, called *azurine*, was produced.

A green colour may also be obtained by heating a mixture of two parts fuchsine with three parts strong sulphuric acid and one part water. When the solution of the fuchsine is complete it is allowed to cool, and four parts of aldehyde are added. The mixture is again heated until it is a bright blue colour without a trace of violet. It is then treated with a boiling solution of hyposulphite of soda, and filtered. The residue upon the filter is to be boiled in water, and filtered while hot. After standing 24 hours it deposits a green precipitate.

Aniline Black.

Several processes have been proposed for making a black dye from aniline, as by acting on aniline with an oxide of chlorine, and then with a salt of copper; but the colour is not of sufficient importance to command attention.

Aniline Yellow.

called *chrysaniline*, or *phosphine*. This colour was first obtained by Mr. Nicholson, in 1861. He procured it from the residuum of rosaniline by the action of steam, whereby a dirty yellow solution was obtained. On adding nitric acid to the solution, the yellow dye was thrown down as a nitrate of little solubility, and by decom-

posing it with an alkali the base is set free, which either alone or in a form of a soluble salt communicates a rich yellow colour to silk and wool.

These are the principal colours obtained from aniline, and it may be of interest to examine the leading properties of these remarkable compounds. At first you will have remarked that the bases of nearly all the aniline colours are very insoluble in water, ether, and coal naphtha. They are more soluble in water acidulated with the mineral acids, and are still more soluble in acetic acid. Alcohol, however, is the great solvent for them. You will likewise observe that they are generally precipitated from their saline solutions by alkalies and by common salt, and in this manner they are generally purified. Tannin also produces an insoluble compound with them, and thus they are often fixed upon vegetable fabrics. They are endowed with great power of resistance, for they will bear the action of strong sulphuric acid without undergoing decomposition, but they cannot resist the action of powerful oxidizing agents, as chlorine, chloride of lime, or nitric acid. Reducing agents, as sulphide of ammonium and protosulphate of iron, destroy their colour; but the action is not permanent, for on exposure to the air oxygen is absorbed, and the colour reappears.

The bases themselves are not generally coloured, but they acquire their characteristic tints when they combine with acids. I have here the colourless, or nearly colourless, solutions of rosaniline, mauvine, and aniline blue, and you will remark that directly I expose them to the vapours of an acid (acetic) their characteristic tints appear.

The tinctorial power of these dyes is remarkably great. If, for example, I put a little Magenta, mauve, or aniline blue upon paper, and then shake off the powder as completely as possible, there yet remains sufficient to give deep tints when I blow a fine spray of alcohol and acetic acid upon the paper.

The affinity of animal substances, as silk, wool, feathers, horn, ivory, leather, &c., is so great that the dye instantly combines with them, and produces a permanent stain. The affinity, indeed, is so great that, as you will here see, a piece of flannel will completely absorb and remove the colouring matter from its solution in water. Vegetable tissues, however, have no such affinity for the colour, and therefore processes must be adopted for fixing the dye upon cotton and linen fabrics. One of these processes is to prepare the fabric with some animal substance, as albumen, serum of blood, the casein of milk, or the gluten of wheat flour. Advantage is also taken of the power which tannin has of combining with the colour and rendering it insoluble. The process of Messrs. Puller and Perkin is to soak the cotton tissue in a decoction of shumach, or other tannin material, for an hour or two, and then in a solution of stannate of soda for another hour; after which it is dipped into dilute sulphuric acid, and is then ready for the dye. By these contrivances the aniline colours are made fast upon all kinds of vegetable fabrics.

Starch appears to have the power of fixing the colours, for if shaken with weak solutions of them it will absorb the colour, and by falling to the bottom of the liquid leave the solution colourless.

Poisoning by Chlorine Vapour.—Professor Maisch says that a direct antidote to the poisonous effects of the inhalation of chlorine is sulphuretted hydrogen, the halogen combining instantly with the hydrogen, liberating sulphur. The professor has tried it himself after accidentally inhaling chlorine, and obtained immediate relief. The same remedy would doubtless be effectual in cases of bromine poisoning.

THE CHEMICAL NEWS.

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ON THE PRACTICAL LOSSES OF SULPHUR, &c., IN THE VITRIOL MANUFACTURE.

By CHARLES R. A. WRIGHT, B.Sc.

THE main causes of the great differences often visible between the amount of sulphuric acid theoretically obtainable from a given quantity of sulphur, and that practically obtained, seem to be three in number, viz. :—

(1). Loss of SO_2 by leakage from burners, pipes, chambers, &c.

(2). Incomplete combustion of all the sulphur used.

(3). Non-conversion of all SO_2 formed into SO_4H_2 and consequent loss of SO_2 by its passage as such into the chimney.

(I). The prevention of the first source of loss is a mere mechanical matter; without great care on the part of the workman a considerable amount of sulphurous gas may escape from the kilns during the process of recharging, &c.; inattention to the speedy repair of all leaks in brickwork, pipes, tunnels, &c., may also cause a considerable amount of loss.

Notwithstanding the manifest bad policy of such a course, it is not uncommon to find a manufacturer neglecting to stop a chamber for repairs until the escape of gases by leakage has almost completely corroded the wooden framework of the chamber. The writer has seen a chamber, when stopped at last, present, to an observer inside, the appearance of a star-spangled sky, owing to the large number of small holes and leaks; in such an instance as this, the loss of time in stopping earlier for repairs and the expense, would have been many times repaid by the saving of sulphur lost by leakage, not to speak of the prevention of damage to the framework of the chamber and to surrounding objects by corrosion. Not only is sulphur thus lost by leakage and diffusion, but excess of air is often drawn into the chamber through the holes, thus practically diminishing the size of the chamber, and still further reducing the yield. It may be noticed here that want of attention on the part of the plumbers in first building the chamber, in so attaching the strap as to distribute the weight of the lead equally, is a frequent cause of small holes and leaks; the leaden sheet is apt to become torn where the strap is attached if too great a strain be upon it, and even if not torn the lead is strained, becomes thinner, and is more readily perforated by the action of the contained gases. The quality of the lead used, too, is of great importance; it is a false economy to buy cheap sheet lead, as it is almost certain to wear unequally, and last a much shorter time than a really good well manufactured article.

Some manufacturers consider it more profitable, in the long run, to pull down a chamber after working four, five, or six years, to melt up the lead, and rebuild with fresh materials, giving extensive repairs to the foundations, framework, kilns, &c., wherever necessary; calculating that the loss of time and capital in thus rebuilding is no more than what would have been necessary for repairs alone had the chamber been kept at work a few years longer; whilst the prevention of damage by leakage and the saving of sulphur render a handsome return for the outlay; others, again, prefer to work a chamber for eight, nine, ten years almost uninterruptedly; in fact for as long as it can by any artifice be made to hold gases.

The following numbers, being the results of successive years' working with a series of chambers to which but little repairs were allowed during the whole time, illustrate the enhanced loss from the increasing leakage :—

Nitric used per 100 parts of sulphur burnt.		Cubic metres of chamber space per kilogramme of sulphur burnt per diem.	Practical yield Theoretical = 100.
1st year ..	9'31 ..	1'150 ..	81'5
2nd ..	9'84 ..	1'073 ..	75'4
3rd ..	10'02 ..	1'017 ..	68'4

It is here manifest that while the sulphur burnt has increased a little, there is a very great falling off in the yield, notwithstanding that the proportion of nitre used is progressively greater; the total amounts lost in the three periods are respectively 18'5, 24'6, and 31'6.

(II). The loss of sulphur from incomplete combustion in the burners is only noticeable to any great extent where pyrites is used. It is almost impossible to burn on the large scale any pyrites so that the burnt residue shall not contain at least 2'5 to 3'0 per cent of sulphur; where slaty pyrites containing about 30—35 per cent of sulphur (such as Wicklow sulphur ore) is used, the residue will probably retain 3'5 to 4'0 as a minimum,* and as this burnt pyrites amounts in weight to about 80 per cent of the green pyrites used, about 8 to 10 parts out of 100 of original sulphur will remain unburnt as a minimum.

When richer ores (such as Huelva) containing 48—50 per cent of sulphur are employed, the residue may contain 3 per cent of sulphur when fairly burnt, and will amount to about 67 per cent of the weight of green ore used; so that about four parts in the hundred of original sulphur remain unburnt. Sulphur may also be volatilized as such, condensing in the pipes, or being carried over into the chambers: this probably is entirely preventable by paying due attention to the temperature of the kilns, supply of air, &c.

(III). The loss of sulphur from incomplete conversion of SO_2 into SO_4H_2 may be due to several minor causes, such as the introduction of too little steam, or too much air; the use of an insufficient quantity of nitre; or what is perhaps, most frequently the case, the allowance of too little chamber space in proportion to the amount of sulphur burnt.

Each manufacturer has a different standard as to the proportion of nitre which should be allowed to a given amount of sulphur; more nitre is required when pyrites is used than where sulphur is burnt, to overcome the dilution of the gases by the nitrogen of the air used to oxidise the iron, &c., contained in the pyrites; more nitre is again required when more sulphur is consumed to a given amount of chamber space. (Vide numbers previously given). The following numbers indicate the average amounts of nitre used by different manufacturers, who have kindly furnished the writer with information on this point :—

Material burnt.	Nitre per 100 parts of sulphur consumed.
Pyrites containing 45—50 per cent of sulphur	8'5
" " 30—50 "	12'0
" " ditto "	10'0
" averaging 35 "	12'5
Sulphur	10'0

N.B. In none of these instances were Gay Lussac's nitre towers employed. For comparison, the following numbers are quoted from Richardson and Watts's *Technological Dictionary*, Vol. 1, Part iii, second edition :—

	Nitre per 100 parts of sulphur used.
Page 71 Sulphur	5'0
317 ditto (Payen, Marseilles)	6'0
318 ditto (Jarrow Chemical Co.)	8'9
317 Irish pyrites (assumed to contain 30 per cent of sulphur, Gossage)	13'3

* With a hard slaty ore, 4 per cent of sulphur is probably below the mark for an average on the large scale; the writer has repeatedly seen heaps of hundreds of tons of such ore, carefully burnt, and yet retaining an average of 5 or 6 per cent of sulphur.

Again, each manufacturer has a different opinion as to the proportion to be observed between the chamber space and the amount of sulphur burnt. Thus the numbers given as an average in R. and W.'s *T. D.*, p. 80, correspond to 1.672 cubic metre per kilogramme of sulphur burnt daily; in "Muspratt's Dictionary," *Art. Sulphuric Acid*, the numbers given as in use in a Lancashire works represent about 1.35 cubic metre per kilogramme, whilst the numbers given before show that less space than this is often allowed. With reference to this point, it may be observed that, as a general rule, it is more profitable to sacrifice a small portion of the theoretical yield (*i.e.*, to cause the amount lost to be greater) in order to produce a greater quantity of a manufactured article, than it is to lessen the amount produced in order to gain the maximum yield possible. Some manufacturers indeed say it is better to strain everything to the utmost, to produce the maximum quantity; of course, however, there is a limit beyond which it is unwise to go, as the increased wear and tear and damage to *quality*, together with the diminished yield, may render this course the least paying.

It is difficult to give more than a rough estimate of the amount of loss which is practically wholly unavoidable. With Huelva pyrites, the results obtained with a large series of chambers furnished with coke towers, but not with Gay Lussac's denitrating apparatus, showed that it is perfectly possible to obtain 82–84 parts of sulphur in the form of acid of specific gravity 1.700 from 100 parts of sulphur used as pyrites; the nitre used being about 10 parts for every 100 of sulphur used; and from 1.100 to 1.200 cubic metre of chamber space being allowed to every kilogramme of sulphur burnt daily. Of the 16–18 per cent of this *total loss* from 4 to 5 per cent were due to the sulphur left unburnt in the pyrites, and consequently about 12–13 per cent to other causes—*viz.*, leakage, non-conversion of SO_2 into SO_4H_2 &c., &c.

"A Practical Chemist" writes to the *CHEMICAL NEWS* of July 13, 1866, that he obtains from a ton of Irish ore, at 30 per cent of sulphur from 18 cwt. 1 qr. 5 lbs., to 18 cwt. 2 qr. 0 lb. of acid of specific gravity 1.75. Acid of this strength at 15°C contains 81.45 per cent of SO_4H_2 (Bineau). Hence his total loss is from 18.0 to 18.9 parts out of 100 of original sulphur, of which probably eight or nine parts are due to the unburnt sulphur in the pyrites.

Payen obtained from 1,600 kilogrammes of pure sulphur 4.280 of acid of specific gravity 1.85 (*i.e.*, of SO_4H_2). [Richardson and Watts's *Technological Dictionary*, I. iii. 317]. Hence his total loss was 12.7 parts in 100.

It would appear, therefore, that whether pure sulphur, rich pyrites containing 48–50 per cent. of sulphur, or poor pyrites at about 30 per cent are employed, from 10 to 13 parts of sulphur out of 100 employed are lost by causes other than the non-conversion into SO_2 of all the sulphur used. This probably represents about the minimum practical loss on the large scale; as noticed before, by bad repair of chambers, &c., &c., this loss is greatly enhanced.

ON THE ANALYSIS OF CAST IRON.

By EDMUND G. TOSH, Ph.D.

(Continued from page 67.)

c. *Wöhler's Chlorine Process.* This most excellent process is carried out in the following way. A weighed quantity of iron contained in a porcelain boat, is placed in a hard glass tube, and exposed at a dull red heat, to the action of chlorine (first dried by passing over pumice stone saturated with sulphuric acid) till no more perchloride of iron is formed. The whole of the carbon remains in the boat, which, when cool, is transferred into a porcelain tube, and the carbon burned in oxygen as before described. An estimation by this method may be performed in two hours. Care must be taken to have the chlorine perfectly free from moisture, otherwise a

portion of carbon may be lost by the formation of hydrocarbons. The results given by this process are very concordant, as the three experiments given beneath show.

1. 1.001 grms. of metal in borings gave 0.1595 gm. of carbonic acid = 4.348 per cent of carbon.
2. 1.06775 grms. of metal gave 0.171 gm. CO_2 = 4.357 per cent carbon
3. 1.002 grms. of metal gave 0.159 gm. CO_2 = 4.327 per cent carbon.

According to Max Buchner*, this process affords results as accurate as those obtained by Berzelius' chloride of copper method; and Professor Kerl of Clausthal states that in his laboratory it is employed almost exclusively.

d. *Weyl's Galvanic Method.*†—This very ingenious and beautiful method for the estimation of carbon is founded upon the fact, that a piece of iron, attached to the positive pole of a galvanic battery, and suspended in hydrochloric acid, is dissolved, while the hydrogen is given off at the negative pole, dipping into the solution. Carbon and hydrogen do not thus come in contact in the nascent condition, and the formation of hydrocarbons, and a consequent loss, is prevented. A recommendation of this method is that the iron does not require to be in powder.

A piece of iron 2 to 4 grammes in weight, attached to the positive pole of a Bunsen's cell, is suspended in dilute hydrochloric acid, just below the surface of the liquid. From the negative pole hydrogen passes off, while the iron dissolves quite quietly, and the strong solution of protochloride of iron formed may be seen falling in a regular stream through the lighter liquid. The iron is dissolved in about 24 hours, and the carbon is left behind in the same shape as the piece of metal from which it was derived.

In Weyl's earlier experiments it was found that some of the liberated carbon at the positive pole was carried over to the negative pole by the mechanical working of the stream. To prevent this, a diaphragm of bladder or parchment paper is interposed between the two, which entirely obviates the possibility of loss in this way.‡

Weyl recommends that the piece of iron should be suspended by means of platina pointed forceps, in such a manner that the acid does not reach the iron at its point of contact with the forceps, otherwise after the partial solution of the iron, the separated carbon intervening between the force points and the remaining piece of metal, would interrupt the galvanic current and the experiment would be lost. In my researches I used a small platinum sieve, kindly lent me by Professor Wöhler, in which I laid the pieces of iron, wholly immersed in the acid, and the action proceeded till the end as well as it did at the commencement. This interruption of the current is not, I think, to be feared, as both amorphous carbon and graphite are good conductors of electricity.

Schnitzler§ when examining this process always found that a small quantity of hydrogen was given off from the piece of iron during solution, and attributed this to the action of acid on small particles of metal which were unconnected with the main piece, distributed through the surrounding carbon, and beyond the influence of the galvanic stream. If we look upon carbon as a conductor of electricity this theory does not hold good. I noticed this evolution of gas in all my experiments, however dilute the acid. Immediately on dipping the piece of iron into the acid, gas bubbles formed on its surface, showing that the action had commenced, which, for my own part, I am inclined to attribute to a secondary and independent galvanic action between the iron and free carbon, either previously existing throughout the metal, or liberated the moment solution begins.

* *Berg- u. Hutt.-Zeitung*, Jahrg. 24. No. 10. p. 84

† *Pogg. Ann.* Bd. iii. p. 507.

‡ *Pogg. Ann.* Bd. 126. p. 617.

§ *Zeit. Anal. Chem.* b. iv. p. 78.

This evolved hydrogen possesses the characteristic odour due to the presence of hydrocarbons, always noticeable when cast iron is dissolved in acids under ordinary circumstances. As shown by Schnitzler, a loss of carbon consequently ensues, and my estimations lead to the same conclusion.

When no more hydrogen is given off at the negative electrode, showing that all the iron is dissolved, the carbon is collected in a small funnel stopped with asbestos, dried cautiously, transferred to a platinum boat, and burned in a stream of oxygen, and the resulting carbonic acid is absorbed in the ordinary way by potash solution. Subjoined are the results of two experiments:—

1. A piece of iron weighing 3.59125 grms. gave 0.5575 gm. $\text{CO}_2 = 4.235$ per cent of carbon.
2. 2.04075 grms. of iron gave 0.30575 gm. $\text{CO}_2 = 4.086$ per cent of carbon.

Weyl† has also proposed a second method for the solution of iron without the evolution of hydrogen, which consists in suspending a piece of the metal in dilute sulphuric acid, containing bichromate of potash dissolved. The carbon is unaffected, and when most of the iron is removed, the residue may be collected and burned in oxygen. I have made no estimation by this means.

Of these various methods I selected that of Wöhler for the determination of carbon in the specimens of iron I have examined, because while recording results of equal reliability with any, its performance requires much less time.

Arranged below in a tubular form are the amounts of carbon per cent, indicated by the various methods, in the same sample of iron.

	Carbon. Per cent.
1. Regnault's combustion process ..	3.886
2. " " " " ..	3.996
3. Fresenius' method ..	4.244
4. " " " " ..	4.166
5. Wöhler's chlorine process ..	4.348
6. " " " " ..	4.367
7. " " " " ..	4.327
8. Weyl's galvanic method ..	4.235
9. " " " " ..	4.086

ON THE

UTILISATION OF THE WASTE PRODUCTS OF THE MANUFACTURE OF COAL GAS.

By DR. LETHEBY.

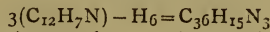
(Continued from page 92).

The rationale of the change which takes place during the formation of the several colours is not altogether clear, although there can be no doubt that the essential part of it is the oxidation of aniline; for, as I have already stated, when a salt of aniline is exposed to the action of nascent oxygen set free from the positive pole of a galvanic battery, the characteristic tints of aniline are successively and quickly produced. At first there is bright yellow, then green, blue, violet, and lastly red, as if these were the successive phases of oxidation. The researches of Dr. Hofmann have demonstrated that all the aniline reds are salts of a well defined base, which he has named *rosaniline*; and the more recent inquiries of MM. de Laire, Girard, and Chaptoteau have shown that there are four such bases entering into the composition of coal-tar colours, as *violaniline*, *mauvaniline*, *rosaniline*, and *chrysotoluidine*, which form an arithmetical series advancing by successive additions of C_2H_2 , thus:—

Violaniline	$\text{C}_{36}\text{H}_{15}\text{N}_3$
Mauvaniline	$\text{C}_{38}\text{H}_{17}\text{N}_3$
Rosaniline	$\text{C}_{40}\text{H}_{19}\text{N}_3$
Chrysotoluidine	$\text{C}_{42}\text{H}_{21}\text{N}_3$

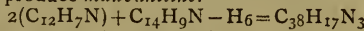
Each of these bodies is produced in the same manner, by the oxidation and removal of 6 atoms of hydrogen from 3 atoms of aniline, or 3 atoms of toluidine, or 3 atoms of the mixed bases, thus:—

6 atoms of hydrogen from 3 atoms of aniline produce *violaniline*.



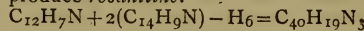
Aniline. Violaniline.

6 atoms of hydrogen from 2 atoms of aniline and 1 of toluidine produce *mauvaniline*.



Aniline. Toluidine. Mauvaniline.

6 atoms of hydrogen from 1 atom of aniline and 2 of toluidine produce *rosaniline*.



Aniline. Toluidine. Rosaniline.

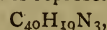
and 6 atoms of hydrogen from 3 atoms of toluidine produce *chrysotoluidine*.



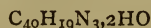
Toluidine. Chrysotoluidine.

These colour bases are perfectly homologous in all respects, for they not only unite with acids to form salts which crystallise very freely, and which have remarkable tinctorial power, but they also contain within them three atoms of typic hydrogen, which may be replaced by certain radicals, as of the alcohols, &c.—methyl, ethyl, phenyl, &c.—forming derivative compounds of like basic properties, and frequently of high tinctorial quality.

The best known of these bases is *rosaniline*, which in its anhydrous condition is represented by the formula



but which always contains two atoms of water in the hydrated state in which it is set free from its compounds, thus:—



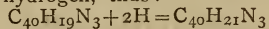
It is readily obtained by decomposing its salts—the aniline reds—with an excess of alkali, soda, or ammonia, and in this state it falls as a dirty yellow or brownish-yellow precipitate; but by careful purification it occurs as a colourless base, which quickly becomes rose-red on exposure to any acid, even the carbonic acid of the atmosphere. It is nearly insoluble in water, slightly so in ammonia, and very soluble in alcohol, forming a deep red solution. Ether and coal-tar naphtha have no solvent action upon it. It combines with one, two, or three equivalents of acid to form salts which crystallize very readily, the first of them, the mono-acid salts, being remarkable for their lustrous metallic or bronze-like appearance and their beautiful rose-red solutions; these, indeed, are the true colouring compounds, the most important of which are the following:—

<i>Fuchsine</i> , or muriate of rosaniline ..	$\text{C}_{40}\text{H}_{19}\text{N}_3, \text{HCl}$
<i>Azaleine</i> or <i>Magenta</i> , the nitrate ..	$\text{C}_{40}\text{H}_{19}\text{N}_3, \text{HNO}_6$
<i>Roseine</i> , the acetate	$\text{C}_{40}\text{H}_{19}\text{N}_3, \text{HC}_4\text{H}_3\text{O}_4$

It was the last-named salt which composed the splendid bronze-like crystals of the crowns which were exhibited in 1862 by Mr. Nicholson. And, besides these, there are sulphate, arseniate, oxalate, chromate, tannate, &c., of rosaniline. Most of them are freely soluble in water and in spirit, but the tannate is so insoluble in water that it is used for fixing the colour upon calico, and for recovering the dye from very weak solutions. To this end the otherwise waste products of aniline red are treated with a fresh infusion of nut-galls, and in a short time the rosaniline is precipitated in the form of a magnificent red lake of tannate of rosaniline, leaving the solution quite colourless. This lake is soluble in spirit and in acetic acid, and may be thus used for dyeing.

The salts of rosaniline with two equivalents of acid have not been studied, and even those with three of acid are not of any technical value.

Under the influence of reducing agents, as sulphide of ammonium, or the nascent hydrogen evolved from zinc when a solution of rosaniline in muriatic acid is left in contact with the metal, it is rapidly decolorized, and is transformed into a new base, which Dr. Hofmann has named *leucaniline*. This is effected by the absorption of two atoms of hydrogen, thus:—

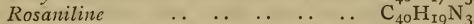
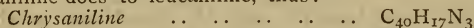


Rosaniline.

Leucaniline.

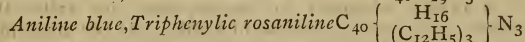
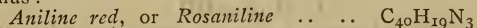
The new base occurs in the form of colourless acicular crystals, which are scarcely at all soluble in water, but freely so in alcohol. The salts of it are also colourless, or dazzling white, although they reacquire the red tint of rosaniline when their solutions are exposed to the action of oxidizing agents or even to the air.

Dr. Hofmann has ascertained that there is still another base derivable from, or closely related to, rosaniline—viz., *chrysaniline*. It is procured from the residual, or waste product of rosaniline, by the action of steam and nitric acid, as I have already described. It contains two atoms less of hydrogen than rosaniline, and therefore it stands in its relation to this base as rosaniline does to leucaniline, thus:—

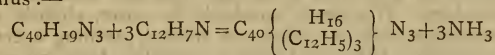


It is very soluble in water, and it forms yellow salts with acids, one of which, the nitrate, is a very soluble compound. The solutions of the base and of its salts communicate a splendid golden yellow colour to animal tissues.

Aniline blues are, for the most part, substitution compounds of aniline red, the three atoms of typic hydrogen being replaced by three of an organic radical. The blue, for example, which is produced by the action of aniline on a salt of rosaniline, is a compound in which the three atoms of hydrogen are replaced by three of phenyl, thus:—



And its production when aniline is heated with a salt of rosaniline is accompanied with the evolution of ammonia, disregarding the acid of the compound, thus:—



Other substitution compounds, in which the three atoms of hydrogen are replaced by three of methyl, ethyl, amyl, &c., have been produced by Dr. Hofmann by the action of the iodides of these radicals on the salts of rosaniline, or even by the more simple and direct process of heating them with the alcohols of the radicals under pressure. All these compounds are basic in their character, and they mostly form, with one equivalent of an acid, the blue colours which are known as Hofmann's blue and violet, and the violet of Paris.

The other bases of aniline and toluidine colours have not been so well studied, but it is very probable that the reactions and the general properties of *violaniline*, *mauraniline*, and *chrysotoluidine*, are very similar to the preceding, and that they are capable of forming the like reduction and substitution bases.

Anti-incrustation Mixture for the prevention of the formation of sediments (strongly adhesive) in steam boilers. 125 kilos. of crystallised chloride of barium dissolved in 50 kilos. of water with addition of 25 kilos. of hydrochloric acid (specific gravity 1.20). To every 1000 litres = 1 cubic metre = 35.5 cubic feet English, 15 litres of this acid solution should be applied.—*Esner's Chemisch. Technisch Notizen.* 1867.

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

It is becoming common now to hear people express the wish that the present Exhibition will be the last for many years to come. But, as is so often the case in other matters, the majority of the persons who talk thus have really no definite reason for what they say. When you ask them for a motive for expressing their objection to exhibitions, you generally get such vague and unsubstantial reasons as "Oh, they are such a bore, you know." "They don't really do any good," or "They injure the retail trade of the cities where they are held." "One is sick of exhibitions," and so on. Now, while your correspondent has never once heard a really sound argument against exhibitions, he has, on repeated occasions, seen and heard enough to show him that the present Paris Exhibition must (if we do not allow our insular vanity to cause us to fall into decadence) exercise a most important influence upon our arts and manufactures.

I contend that no Englishman of sound judgment could possibly examine in detail, as your correspondent has done, the various departments allotted to the European kingdoms, without having the fact forced upon him that our neighbours are running abreast of us in a race which, if we lose, will disgrace us for ever.

The intense dislike which a vast number of influential people took to all the schemes of the late Prince Consort, led them to oppose everything connected with his attempts to encourage technical education. But, if we are to retain our supremacy—nay, if we are not to be ignominiously beaten in the very departments where we have somewhat too superciliously fancied ourselves invincible, we must not only soundly educate our workmen in all the subjects relating to their special avocations, but we must also stimulate their ambition.

Fortunately the minds of some of the most active and far-seeing of our scientific and political men are directed to this deeply important question, and your correspondent trusts that you, Mr. Editor, will keep the matter before the scientific public.

To chemists the matter is as important as to engineers and artists. The chemical manufactories of France and Germany, especially the latter, are always able to obtain the services of men who, having received their chemical education in laboratories directed by high-class men, are able to devise new processes, improve those already existing, and, especially, to adopt, simplify, and cheapen methods invented in this country, so as to deluge our markets with low-priced and often good articles, to the serious injury and even ruin of our own manufacturers.

Of all the faults which tend to the perpetuation of the system, or rather want of system, under which we are now obstinately insisting on learning how to be beaten, the greatest is the stupid vanity which leads us to underrate the strength and, above all, the intelligence of our rivals. We know how ruinous this is in war; it is equally so in the conflict between English and foreign manufacturers.

Now that the Universities generally are to be represented, such men as Playfair and Lowe will find a proper sphere, and will, we doubt not, force this matter upon the attention of Government. Whether our present men in office will take up the matter is another affair; on the Continent the idea appears to be that our administrators are too busy with the political questions of the day to do anything towards the advancement either of science or art. Unhappily it needs no ghost to tell us that the "country gentlemen" who do us the honour of governing us, feel very little interest in the matter, and the so-called representatives of the trades are too much occupied with supporting strikes, to see that the prosperity of those whose interests they betray, are in reality dependent upon questions of which violent and uneducated men do not even know the existence.

But all this cannot last for ever; foreigners who only judge of us by our newspapers, ask with astonishment, "But these MM. Broadhead, Beales, and Whalley, who are they?" As soon as our workmen are properly educated they too will ask similar questions; and it will then be seen that the workman's friend is not he who shows him how to strike against his employer, but he who shows him how to develop to the utmost those great gifts of intelligence, patience, skill, and strength which for so many years made British engineers and manufacturers the astonishment of the world.

Before concluding this letter, your correspondent must again protest against the use of exhibitions as mere advertisements for the exhibitors. I contend that the committees to whom is delegated the power of acceptance or refusal, should resolutely refuse admittance to articles which do not show upon the face of them the condition of the industry which they represent. When Messrs. Wood and Co. send a few bottles of effervescent drinks which for all that appears might be merely water, I say they should be refused admission. They may be of the highest class, but as they stand in the case they show nothing that may not equally well be seen in the window of a restaurant. It is true that one bottle, by leaking a little, tries its best to attract attention, and by pouring out a sorry libation to earth may perhaps get removed to a more congenial sphere where soda-water bottles are at rest.

To return, your correspondent trusts that you, Mr. Editor, will not think that he has dwelt too much upon the subject of the industrial education of the working classes in this country. The question is of vital importance, and it is only by the publicity attainable through the medium of the scientific journals that the inertia of the masses can be successfully overcome.

It shall not be said that I have sent you a letter upon the Paris Exhibition in which no allusion is made to the contents of the building, so I will now proceed with my notes upon the English section.

13. Calley, Samuel, New Road, Brixham, Devon. Specimens of "Torbay," iron oxide paints, and compositions for ships, metal sheathing, &c.

The problem of producing a good sound paint of various colours suitable for wood, iron, and stucco-work, with a base of iron instead of lead, has certainly been creditably solved by Mr. Calley. In addition to extreme cheapness they are free from the deleterious character of lead paints, and are said to be much more lasting. The inventor states that a square yard of iron can be covered for one farthing, and that the labour in applying them is considerably less than with ordinary paints. In fact, from careful experiments it has been ascertained that Calley's paint brought to a working consistency with 45 per cent of its weight of linseed-oil, covered four square yards for one penny, the labour required being only 60 per cent of that required for lead paint. It appears from what we have been able to gather that these paints are principally made from a native oxide of iron found at Brixham in Devon. The paints produced are of two kinds. Those of the first class, which are principally adapted for iron-work, appear to be made direct from the native oxide. Variety of hue is obtained, we believe, by subjecting the ore to various temperatures.

Calley's colours of the second class are tinted by admixture with metallic substances capable of yielding the desired shades. One experiment that was made to determine the comparative resisting powers of lead paint and iron-oxide paint to heat, is certainly sufficiently remarkable to deserve mention. Some sheets of iron were covered on one side with Calley's oxide paint, and on the other with red-lead. One of these, when thoroughly dry, was placed over an open coal-fire, the oxide-painted side downwards. The upper or red-lead side soon began to crack and blister, whilst the oxide-paint still adhered to the iron, and only changed its tint. In further trials it was found that at a temperature which approached a red-heat, the oxide paint was only deteriorated, while the red-lead was completely destroyed.

REPORTS OF SOCIETIES.

BRITISH MEDICAL ASSOCIATION,

TWENTY-FIFTH ANNUAL MEETING, 1867, HELD IN DUBLIN.

DR. CHARLES A. CAMERON read a paper, in the Physiological Section, on the "*Assimilation of Gelatine.*"

The author re-opened the question of the nutritive value of gelatine. He considered that the French Commissioners on this subject had gone too far in denying the alimental value of this substance. He pointed out as strong arguments in favour of his views as to the assimilation of gelatine, the facts—that that substance when largely used as food passes off in the form of urea, and is not found in the fæces. As gelatine passes rapidly from the stomach into the circulating fluids of the body, and becomes decomposed therein, it is impossible not to assign to it some useful functions. The author then described some experiments which he had made on this subject. He employed the dog and the white mouse, the latter animal being peculiarly well-adapted for such experiments. He found that these animals could not live on food consisting of gelatine, fat, butter, sugar, starch, and mineral substances. This was the result the author had expected, for the following reasons. In the nitrogenous portion of animals there exist sensible amounts of organic sulphur and phosphorous compounds ("alloxidic"). Gelatine does not include these elements, and is therefore incapable of forming muscles and nerves. The addition of mineral sulphates and phosphates to gelatine does not increase its nutritive value, because animals are not endowed with the power of organizing mineral sulphur and phosphorus, although this function is the attribute of plants.

In some of the fats of the brain and nervous tissue generally there are notable proportions of organic and unoxidised phosphorus and sulphur. By combining these phosphorised and sulphuretted fats with gelatine, and adding thereto some other non-nitrogenous and mineral substances, Dr. Cameron formed a food on which mice lived for forty-two days in a very healthy state, although the said food was deficient in albumen and fibrin.

Taken under ordinary circumstances, gelatine, according to the author, is most probably employed as a calorific, and perhaps also as a source of motive power. In an agreeable form it was a food very much relished by invalids, and there was a good reason underlying the popular practice of making gelatine a common article of food.

MR. TICHBORNE read a paper, in the same section, on the "*Organic Matter in Potable Water.*"

He dwelt at some length upon the difficulties attendant upon water analyses. The point of difficulty in the examination of potable waters being not so much their quantitative as the qualitative examination—particularly as regards their organic constituents—you may have a water rich in organic matter yet harmless, or a water containing but a minimum of organic matter of the most deleterious nature. He remarked that all the following points in an analysis had an important bearing upon the state of the organic matter, viz. nitrates, nitrites, ammonia, total nitrogen, odour, taste, colour, hardness, chlorides, iron, gases dissolved, microscopic examination, &c. The author gave a quick method for estimating the nitrites in potable water, based on the conversion by heat of nitrite of ammonium into nitrogen and water—the loss being estimated by a volumetric solution of permanganate of potassium. Mr. Tichborne then described a tube or convenient instrument for viewing the colour of water, and for examining the state of oxidation of the iron salts or matter of some importance in connection with the organic matter, and a point not so easy to determine in very diluted state—as the microscope magnifies the form, so this instrument magnifies the colour, or colour tests, so as to be recognisable

to the eye. When the iron bears any *considerable proportion* to the organic matter, very little of the latter will be found (if we except ammonia), providing the iron is in the state of a ferric salt. If, however, the iron is present as a ferrous salt, it will be found to have exerted little or no influence on the organic matter, and frequently such waters (except chalybeate springs) will be found to contain large quantities of soluble organic matter.

The author remarked that it had been stated that charcoal that had been used, some time, so far from taking from the water the organic matter, gives up again a certain amount. That water on analysis before and after passing through old charcoal was more contaminated with organic matter, after having been passed through the said filtering medium. The *modus operandi*, however, by which charcoal acts is not so much by any attractive power that it possesses, that is to say, it does not absorb the mass of the organic matter, but acts as one of the most powerful oxidizers. The oxygen condensed within the charcoal acting more energetically than the available oxygen we can apply in the form of permanganate of potassium. A charcoal filter was found from actual observations to work wonderfully well, and to retain its vitality for a long period, with the following provisions. That the water passed through it did not contain a very large percentage of organic matter. That it was not continuously at work, that is to say, that the charcoal was exposed to the atmospheric oxygen (with as little of the dust as possible) the better part of each twenty-four hours. That the water was passed through a filtering medium before it came in contact with the charcoal. If not, the charcoal acted as a mechanical recipient to the insoluble organic matter, which at last accumulates to such an extent as to enter into a state of fermentative change; the activity of the charcoal being by this time exhausted, or at least only sufficient to supply a minimum of oxygen would only assist such a decomposition. This state of the case would be simply the putrefaction of a mass of organic matter independent of the charcoal, not the rendering back from the charcoal of something it had absorbed from the water.

Mr. Tichborne exhibited a table of the action of permanganate of potassium upon organic substances, which illustrated the worthlessness of that substance as a measure of fermentable matter. He also stated that peroxide of hydrogen, if it could be procured *pure*, and at a reasonable price, might be used with advantage, for the purification of water.

The only other papers read at these meetings, possessing a chemical bearing, were: Dr. Protheroe Smith "*On the Mode of Detecting Impurities in Tetrachloride of Carbon*," and Dr. O'Leary "*On the Thermal Value of Food*," &c.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

New Series of Sulpho-compounds.—A. Saytzeff.—Sulphamylic oxide, $(\text{C}_5\text{H}_{11})_2\text{SO}$, fuses at $37-38^\circ$. Zinc ethide, ethylic, or amylic iodide are without action upon it; when heated with hydriodic acid in sealed tubes to 100° a brown oil, insoluble in water, is formed. The acid liquor remaining, after sulphamylic oxide has been separated, contains a small quantity of amylsulphurous acid.

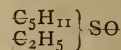
Butylic sulphide, $(\text{C}_4\text{H}_9)_2\text{S}$, is formed by heating butylic chloride with an alcoholic solution of potassic sulphide; it separates from the mixture on addition of water as an oily liquid which, after having been dried and rectified, boils between 176 and 185° ; it is insoluble in water, soluble in alcohol and ether. Amylethyl sulphide



is obtained by treating sodic amyl-mercaptide,



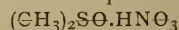
with ethylic iodide as a transparent liquid, insoluble in water, and boiling at $158-159^\circ$. Treated with fuming nitric acid, the oxide



is formed, besides a trace of an acid, containing sulphur. These observations differ from those of Carius, who gives the boiling point of the sulphide at $132-133.5^\circ$, and who has obtained ethylsulphurous acid as the only product resulting from the action of nitric acid.

Sulphethylic oxide, $(\text{C}_2\text{H}_5)_2\text{SO}$, is obtained by the action of nitric acid on ethylic sulphide; it is a thick, nearly colourless liquid, which crystallises on cooling. Reducing agents reconvert it again into ethylic sulphide; further oxidation produces diethylsulphan.

Sulphomethylic oxide, $(\text{CH}_3)_2\text{SO}$, is prepared, like the ethyle-compound, by acting upon methylic sulphide with strong nitric acid; the same reaction gives rise to the formation of nitrate of sulphomethylic oxide



which is a crystallisable, deliquescent salt. If a solution of the methylic sulphide in nitric acid is heated for several hours in a sealed tube methylsulphan is formed, which is soluble in water, fuses at 109° and boils at 238° . The action of methylic iodide on amyloethylic sulphide was expected to result in the formation of the compound $\text{S}(\text{CH}_3 \cdot \text{C}_2\text{H}_5 \cdot \text{C}_5\text{H}_{11})_2$; instead of this, however, iodide of trimethylsulphin $\text{S}(\text{CH}_3)_3\text{I}$ was formed, besides ethylic and amylic iodide.—(*Zeitschr. Chem. N. F.* iii. 358.)

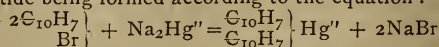
Sodic Hydrate, Crystallised.—E. Schöne. A hot saturated solution of sodic hydrate begins to crystallise when cooled to between 40 and 50° . The crystals have the composition $\text{Na}_2\text{O} + 5\text{H}_2\text{O}$ or $\text{Na}_2\text{H}_2\text{O}_2 + 4\text{H}_2\text{O}$. They are very deliquescent, but after being thoroughly dried upon a porous surface under the desiccator, do not fuse below 80° .—(*Zeitschr. Chem. N. F.* iii. 383.)

Thionessal.—M. Fleischer. The formula of thionessal according to the author is $\text{C}_{28}\text{H}_{26}\text{S}$, instead of $\text{C}_{26}\text{H}_{18}\text{S}$ as stated by Laurent and Märker. Bromine substitutes three atoms of hydrogen, forming $\text{C}_{28}\text{H}_{17}\text{Br}_3\text{S}$ which may be obtained in crystals from its solution in petroleum (of a high boiling point) fusing at $265-267^\circ$. This compound again treated with bromine is converted into $\text{C}_{28}\text{H}_{16}\text{Br}_4\text{S}$. Potassic chlorate and chlorhydric acid oxidise all the sulphur of thionessal into sulphuric acid, converting it thereby into the compound $\text{C}_{14}\text{H}_{10}\text{O}$, which fuses at 214° . Phosphoric chloride forms $\text{C}_7\text{H}_5\text{Cl}$ (or $x\text{C}_7\text{H}_5\text{Cl}$), fusing at about 130° . Fuming nitric acid first produces the nitro-compound $\text{C}_{28}\text{H}_{16}(\text{NO}_2)_4\text{S}$ which subsequently is converted into a body, free from sulphur, probably $\text{C}_{14}\text{H}_{10}(\text{NO}_2)_2\text{O}_3$, and finally into nitrodracrylic acid. Fuming sulphuric acid dissolves thionessal with disengagement of sulphurous acid and formation of the acid $\text{C}_7\text{H}_6\text{SO}_4$, the baric salt of which has the composition $(\text{C}_7\text{H}_5\text{SO}_4)_2\text{Ba} \cdot 4\text{H}_2\text{O}$. The compound produced by the action of soda-lime seems to be totally allylic sulphide $\text{C}_{14}\text{H}_{10}\text{S}$.—(*Zeitschr. Chem. N. F.* iii. 376.)

Mercuric Naphtide.—R. Otto. Sodium-amalgam was made to act upon monobromnaphtalene, diluted with several times its volume of benzol (boiling between 120 and 140°) in the hope of getting dinaphtyl

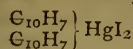


The reaction, however, proceeded differently—mercuric naphtide being formed according to the equation:—

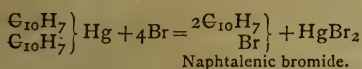


Mercuric naphtide, which may thus be prepared with ease, and in any quantity, crystallises in white needles, soluble in hot benzol, sparingly so in alcohol, insoluble in water; they fuse at 248° .

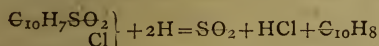
When heated with lime naphthalene principally is formed, but no dinaphthyl. Iodine combines with mercuric naphthide, forming mercuric di-iodmercaptide,



which crystallizes from hot alcohol in beautiful silky needles. Bromine added in excess acts in the following manner:—

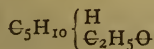


By the action of sodium-amalgam sulphonapthalenic chloride is resolved into naphthalene and sulphurous acid:—



(*Zeitschr. Chem.* N. F. iii. 377.)

Isomer of Ethylamyle, and Observations on Mixed Ether.—Reboul and Truchot. When hexylic chloride is acted upon by alcoholic potassic hydrate, hexylene C_6H_{12} is formed (Pelouze, Cahours), but besides this ethyl-hexyl; heptylic, octylic and decylic chloride likewise are converted into both the hydrocarbon and mixed ether; hexylic chloride gives chiefly ethyl-amyle, but also some amylene, even ethylic bromide yields besides ethylic ethide, ethylene. This reaction, therefore, is a general one, the members of the series differing in this respect, that the lower ones give rise to the formation of mixed ether principally, while those of higher atomic weight yield hydrocarbon more abundantly. By the action of alcoholic potassic hydrate upon amylenic bromhydrate a body is obtained of the composition of ethyl-amyle, but differing from the latter in boiling-point by about 10° , as also in its behaviour towards hydrobromic acid,—ethyl-amyle forming ethylic and amylenic bromide, the isomer ethylic bromide and amylenic bromhydrate. The authors propose for the isomeric compound the formula:—



(*Comptes R.* lxiv. 1243.)

NOTICES OF BOOKS.

Germinal Matter and the Contact Theory. JAMES MORRIS, M.D. Lond., Fellow of Univ. Coll., Lond. London: John Churchill and Sons, New Burlington Street. 1867.

THE author of this small pamphlet of twenty-three pages, in the first enters his plea in the following skilful manner,—"Depreciation due only to baseless theories is too often extended to theory in general, but even a theory that does no more than harmonize a large number of facts, is a useful aid to further progress, and is often the means by which we arrive at a law." As a rule the largeness of the number of facts is in direct ratio to the looseness of the theory, as opposed to law. A medical theorem is then worked out *seriatim*, by what the author calls three easy steps; we may call them his axioms.

Axiom I. "Air floats with ease and for a considerable time and distance, light, and small masses of organic matter." Well-known facts are quoted for this, but a certain vagueness of expression somewhat tends to embarrass the reader, e.g., "Seeds of all sizes sail in the air, from the thistle or taraxacum, with their parachutes of bristles, down to the smallest floated by its thread of cotton." A rigidly accurate reader might feel disposed to quibble about this statement, as is his wont; seeds of all sizes include horse-chestnut and cocoanut seeds, and evidence of their being floated by air is still wanting.

Axiom II. Minute portions of organic matter are constantly thrown off by animals and men.

Axiom III. These are received into the body, and some pass into the lungs so as to reach the blood.

These are not to be disputed, and the theorem follows, "Light little masses from the body of one individual are constantly received by other individuals so as to reach their blood."

An interesting number of facts are in the next place cited, to show what diseases are known to be caused by essentially molecular causes, those known to be caused by organic (*i.e.* organized) agencies; thirdly, the grounds for suspecting their presence in other diseases. Dr. Beale's researches are also quoted in terms of the highest praise; "to him we owe the outline of what I conceive to be a generalization, hereafter probably to rank as a landmark in medical science." The pamphlet as a whole we esteem highly, more especially for its clear ordination of facts, and the plainly stated facts for the axioms necessary to work out a theorem. Dr. Morris is an author whom it is very easy to follow in argument, and it is a pleasure to read a pamphlet written on his plan; these good points are so much enhanced by comparison with works that now-a-day abound with theorems without axioms, based neither upon experiment with full details, nor upon high authority with references, judiciously selected.

Propriétés Desinfectants des Permanganates Alcalins. HENRY BOLLMAN CONDY. Paris: J. B. Baillière et Fils. 1867.

THE readers of the CHEMICAL NEWS doubtless remember the tenor of some remarks made in this journal under the heading, "French Academicians and English discoverers;" from our later numbers also they have learnt that Sir Isaac Newton himself is not to escape; and although we are sorry that Mr. Condy should have occasion to assert his right of priority of discovery, we congratulate him heartily at finding himself in such good company, and ourselves for this opportunity of learning the whole history of the application of the permanganates to disinfection, afforded by the necessity of publishing such a claim.

Mr. Condy observes truly, that although M. Marguerite in 1850, and MM. Bussy, Florès-Domonte, and Péan de Saint Giles still later, advocated the application of the permanganates and manganates for oxidizing purposes; they did so merely for purposes of chemical analysis; and the proof of commercial application being still unrecognized, is found in there being no exhibition of these salts at the French Exhibition of 1855. Towards the end of this year Mr. Condy first showed these disinfecting powers. We have in Appendix A the most complete verification of Mr. Condy's views from the highest authority, Professor Hofmann; this document is dated July 21, 1856. In spite of this M. Castex claimed, in 1863, from the Academy of Sciences, a recognition of his discovery of these properties. Mr. Condy thereupon, by Dr. Mitchell, addressed to the Academy a most unanswerable reply to M. Castex's claims. This called forth in reply a letter addressed to the Academy by a Dr. Blache (March 24, 1864), and this will be for some time memorable in the history of invention as an unexampled specimen of cool impertinence; we quote—

"Et puis nous ferons remarquer que ce n'est pas l'idée seule qui fait le mérite d'un travail, surtout d'un travail qui a un but pratique; c'est la poursuite de cette idée dans les faits. . . . M. Castex a expérimenté par lui-même; il nous fait connaître des faits puisés dans sa propre pratique. Ces faits sont bien à lui. Ces faits ne sont pas ceux de M. Condy; et s'ils confirment ceux de M. Condy, tant mieux"!!

Dr. Blache admits the discovery, but disputes the full demonstration by a series of experiments, in effect, if not directly, by attributing such a series of experiments to somebody else.

The history of this case may be taken as a pattern of the flimsy way in which French chemists have lately been in the habit of making discoveries. We can discover nothing in Mr. Condé's language that shows anything but the strictest courtesy, truth, and confidence in the justice of his claim.

CORRESPONDENCE.

EQUIVALENCE, QUANTIVALENCE, AND CHEMICAL VALUE IN EXCHANGE.

To the Editor of the Chemical News.

SIR,—In an able review of an excellent book (Dr. Miller's "Elements of Chemistry") published in your current number, I observe an error, evidently inadvertent, yet of a kind so frequently made, and tending so much to confusion of thought, on topics which it is essential to keep clear in the mind, that a few lines of your valuable space may not, I think, be misapplied in its correction.

In the absence of my friend Dr. Hofmann, this duty devolves, I feel, upon me; because the error in question consists in the misquotation of a term proposed by us, in lieu of the vague, and, as your critic justly calls it, "barbarous" expression *atomicity*. The substituted appellation is not, as your reviewer writes, (doubtless by a mere slip of the pen), "*equivalence*," but "*quantivalence*."

As both these expressions are retained by us, each having, in our view, its special scientific value, and only the meaningless word "*atomicity*" being abandoned, it is absolutely essential to philosophical precision that the two words in question should be scrupulously employed, each only in its peculiar sense, as contra-distinguished from the appointed meaning of the other.

Now, the term "*equivalence*" is set apart to denote the *molecule-forming* power of an element, while "*quantivalence*" is expressly reserved to signify its *atom-fixing* capacity.

Both these are essentially ponderal values—capable of being numerically expressed as combining-weights, in terms of the same standard unit, viz., $H=1$.

The molecule-forming power of any element corresponds with the minimum-weight thereof, relatively to hydrogen as unity, capable of taking part in the formation of a compound molecule.

The atom-fixing capacity of any element is proportional to the minimum-weight thereof capable of engaging, or conversely, of expelling and replacing, one standard atom; $H=1$ being the standard.

The former of these two values constitutes, for each element, its *equivalent*, in the ordinary acceptance of the word, which is synonymous with *atom-weight*, and *combining number*. It will be remembered that, for the volatile elements, these equivalents correspond (*exceptis excipiendis*) to the respective *gas-volume-weights*, or *vapour-densities*, relatively to hydrogen taken as unity.

The latter of the two values, as I have elsewhere pointed out, might properly be represented, for each element, by attaching to it a second ponderal equivalent, or representative number, most frequently a fraction of the former,—a moiety, a third, or a fourth,—to denote the smallest quantity by weight capable of fixing, or replacing one standard atom.

This mode of notation would give us two parallel sets of minimum-weights, or combining numbers, each element possessing a pair; and the two being distinguishable, in most cases, as the *major* and *minor* equivalent.

I say "in most cases" because, for chlorine and its congeners, the two equivalents would coincide.

These duplicate equivalents, for the typical elements, would be, respectively, in terms of hydrogen as unity:—

	Major.	Minor.
For oxygen	16	8
„ nitrogen	14	4.66
„ carbon	12	3

while, for chlorine, 35.5 would represent both values.

It is, however, obvious, that the extension of such a duplicate system to 62 or more elementary bodies, would severely tax the memory and the attention, (faculties of sadly limited scope, always to be most studiously husbanded), besides also seriously impairing the succinctness of the symbolic notation, so invaluable as our chemical "short-hand."

This short-hand, as commonly practised, represents each element by its initial letter, with which we associate, by a comparatively easy habit of the memory, its molecule-forming minimum-weight, or ordinary combining equivalent.

The symbol, so far prepared, is ready to have engrafted on it the further conception of *quantivalence*; which we can now exactly define.

"*Quantivalence*" is the atom-fixing power of the respective elements, denoted, for each typical group, by a special coefficient, whereof the index is attached, for each member of the group, to the initial letter with which is associated its name and ordinary equivalent number; the result being an exceedingly concise symbol, embodying, together with a Name, two distinct conceptions of chemical Value, with their respective Quantities.

As all the simple bodies fall naturally, in respect of their quantivalence, into four typical groups, headed respectively by the four elements cited above, the members of each group, how different soever their molecule-forming weights, correspond with each other as *univalent*, *bivalent*, *trivalent*, or *quadrivalent*, in their atom-satisfying relations.

We have only, therefore, to bear in mind this easily-remembered fourfold classification, with its simple quantivalence indices (dashes or Roman numerals at choice), in order to have constantly at hand for use, all the information that the long lists of duplicate equivalents, so burdensome to the memory, must otherwise have been employed to supply.

The disburdenment of memory, and the terseness of symbolisation, thus simply attained, acquire additional value from the happy circumstance that the atom-fixing and volume-condensing powers of the elements advance *pari passu*; so that, (*exceptis excipiendis* once again) the coefficients of quantivalence serve to condense into our symbols, and so to keep impressed upon our minds, besides the several ranges of facts above mentioned, this further collateral information.

Confining attention, however, to the main conceptions, distinct though allied, of equivalence and quantivalence as above defined, it is by carefully coupling these together, yet as carefully avoiding to confuse them, that we are enabled to contemplate accurately, in its two opposite aspects, that which I have ventured to term *Specific chemical value in exchange*.

Nothing, I think, can now be clearer than that this value, so frequently misunderstood, presents itself in two aspects, and as of two kinds, accordingly as we contemplate it relatively, on the one hand, to the formation of molecules, or, on the other, to the fixation or displacement of atoms.

Adopting the first stand-point, we clearly perceive that 12 parts by weight of carbon are "worth" (in financial parlance) as much as 14 of nitrogen, 16 of oxygen, 35.5 of chlorine, and so forth.

Placing ourselves at the second point of view, we as clearly see that an atom of any element in the quadrivalent group is "exchangeable at par" for four atoms of

any element in the univalent group, and for three and two atoms respectively, of any element in the trivalent and bivalent groups.

I should trespass unduly on the hospitality of your valuable columns, were I to prolong these elucidations, otherwise I would fain trace out a little further the nature and consequences of these admirable relations. Among other such illustrations on which I would gladly dwell is one that I was permitted to adduce in a little book which you were pleased to notice with approval on its first appearance, and which your reviewer cites. I allude to the curious and beautiful quantivalential equipoise, or symmetry, which I have observed to prevail among the five members of the nitroxygen series.

These singular relations will be found displayed at pp. 181, *et seq.*, of the work referred to, in a diagram expressly constructed to show the characteristic feature of this remarkable series; with its central body in the self-balanced structural condition, which I have ventured to call *equiquanticiety*; while its two wings form exact quantivalential counterparts, equal, though conversely reflecting one another, as each departs, by opposite grades of declension, from that self-centred archetype.

I forbear, however, from a dissertation which would tempt me too far; and, reverting to the purpose with which I set out, I beg, in conclusion, by way of summary,—while acknowledging your reviewer's manifest ability—to deprecate the confusion which his *lapsus calami* (nor his alone) tends to introduce between conceptions so fundamentally distinct as those of chemical *equivalence* and *quantivalence*; signifying as they do, two opposite forms or aspects of "chemical value in exchange,"—those, namely, which we trace, respectively, in the *molecule-forming* and *atom-fixing* powers of the elements.—I am, Sir, &c.,

F. O. WARD.

London, August, 1867.

MAGNETISM AND GRAVITATION.

To the Editor of the Chemical News.

"A. D." admits that the force of magnetic attraction varies inversely as the square of the distance, and yet arrives at the singular conclusion that "when the distance between the pole of a magnet and a magnetic body is very considerable as compared to the size of the latter, the body will not be attracted." According to "A. D.'s" views, therefore, if a small particle of iron, say a single molecule, were placed at a distance of a quarter of an inch from the pole of a magnet, it would not be attracted, because the distance of a quarter of an inch would be inconceivably great compared with the length of a molecule of iron. Now, if this holds good for one molecule of iron, it holds good for any number of molecules, for the attraction of a mass may be regarded as made up of the attraction of the molecules of which it is composed. So that "A. D.'s" process of reasoning, legitimately carried out, leads to the remarkable result that a piece of iron would not be attracted by the pole of a magnet placed at a distance of a quarter of an inch from it, "which," to quote a well-known author, "is absurd."

It must be borne in mind that all I have contended for is that, theoretically speaking, just as a magnet placed under a balance increases or diminishes the apparent weight of certain substances introduced into the pan of the balance, so the weights of substances, at ordinary temperatures, on the earth's surface are not their absolutely true weights. That is to say, they are not entirely due to the force of gravitation, but a part, it may be an inconceivably small part, of the apparent weight, is due to the magnetic attraction and repulsion of the earth, and of the atmosphere by which it is surrounded.

On this point I would quote "Watts's Dictionary," vol. iii., p. 774, where we read that "a cubic mètre of oxygen gas would act on a magnetic needle with the

force of 54 centigrammes of iron, and a cubic mètre of air with the force of 11 centigrammes of iron. The whole atmosphere is consequently equal in magnetic power to a shell of iron covering the whole earth to the thickness of 0.1 millimètre."

If bodies were weighed at high temperatures, that portion of their weight which was due to the magnetic attraction of the earth, would almost entirely disappear, and hence the weight of a given quantity of iron would be, theoretically, less if weighed at a red heat than if weighed at ordinary temperatures.—I am, &c.,

JOHN A. R. NEWLANDS, F.C.S.

Laboratory, 19, Great St. Helen's, E.C., Aug. 13, 1867.

CO-OPERATIVE CHEMICAL CLUB.

To the Editor of the Chemical News.

SIR,—It occurs to me that in these days of co-operation, it might be a good thing to form "chemical and physical clubs" in various parts of the country wherever sufficient numbers of co-operators could be obtained. There are many, I daresay, like myself engaged in commerce, manufactures, or the professions, who love science for its own sake, and from various causes cannot acquire a laboratory worthy of the name, who would gladly contribute a considerable sum yearly for the privilege of having the use of a well-stored laboratory, and intercourse with others having similar tastes and pursuing similar studies. If there were clubs of this sort in all our large towns, I am sure they would tend greatly to advance the cause of science and to spread a *correct* knowledge of it in many quarters where at present it is but little understood.

It would tend to success were some influential gentleman to bring the subject before the British Association next month, and have clubs instituted under its auspices.

If you consider this idea at all practicable, I shall be obliged by your inserting it in your widely-circulating journal.—I am, &c.

WM. DURHAM.

Currie, near Edinburgh, August 17, 1867.

[The idea is excellent, and we shall be happy to give it all the support in our power.—Ed. C.N.]

SPECIFIC GRAVITY PROBLEM.

To the Editor of the Chemical News.

SIR,—Your correspondent "C. H. P." may well be astonished at the reduced sp. gr. of the iron as obtained by his calculation (1.10306). He will find, however, that this lowness is due entirely to the mistake which has been allowed to creep into the method adopted for ascertaining it, and not at all to any error in the observations of *Sideros*, for, working the problem out correctly from them, the sp. gr. is obtained nearly double what it should be, if the substance is iron! The system he has adopted is a proper one, and that given in "Fownes" (in the 8th ed., page 8) for finding the sp. gr. of substances lighter than water, and may be applied to this case thus:—

Weight of iron and olive in air		50 gns.
" " " " water		41.8 "

Weight of water equal in bulk to iron and olive		8.2 "
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Weight of olive in air		20 "
" " " " water		13.75 "

Weight of water equal in bulk to olive		6.25 "
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Weight of water equal in bulk to olive and iron		8.2 "
Weight of water equal to olive alone		6.25 "

Weight of water equal in bulk to iron		1.95 "
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Weight of iron in air		30
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Weight of water equal in bulk to iron		1.95
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= 15.384 =

=sp. gr. of the iron according to *Sideros'* proposition, which brings it to the same result as in my calculation of last week. "Lloyd" would have obtained a more accurate result also with his ingenious formula, had he not unfortunately made a mistake in multiplying $3 \cdot 2 \times 6 \cdot 1 \times 30$, which is $585 \cdot 6$, and not $575 \cdot 6$, as given in his solution.

The method worked out above is accurate, but it may be interesting to consider the reasoning by which a shorter method for working out all problems of this character may be arrived at.

Supposing a body weighing A grains in air,
weighs in water a grains.
And another body weighing B grains in air,
weighs in water b grains.
Then the two together, A+B,
will weigh in water a+b gns.

This is self-evident, it only requires stating to be perceived, for the body which weighs A in air will displace the same bulk of water when attached to or mixed with that weighing B, that it did when by itself, and the same holds true of that weighing B; consequently their united action on the balance must be the sum of the weights obtained when immersed separately. This established, it will be easy to see that if a body weighing A+B in air, weighs in water a+b, and one of its components weighs A in air, and in water weighs a, then the second component weighing B in air, must in water weigh b. This last term, which is all that is wanted for obtaining the sp. gr. of the second component, being obtained by subtracting a from a+b in the same way that its weight in air was obtained by deducting A from A+B.

Bearing in mind the nature of the difference between those substances which are heavier and those which are lighter than water, this system becomes applicable to the solution of the interesting problem of finding the sp. gr. of substances of the latter class; all that is required being great attention in the use of the signs during the calculation.

As an example, let us take that in "Fownes," already alluded to. The problem is to find the sp. gr. of a piece of wax, this is attached to a piece of brass in order to make it sink in water.

Brass and wax together in air weigh $183 \cdot 7$ grms., in water $38 \cdot 8$
Brass alone in air weighs 50 " " " $44 \cdot 4$
Subtracting we obtain—
Wax alone in air $133 \cdot 7$ " " " $-5 \cdot 6$
But to find the sp. gr. of a substance, we must deduct the weight in water from that obtained in air, and this difference becomes the denominator of a fraction representing the sp. gr. of the substance, and of which the numerator is its weight in air, i.e.—

In this case the sp. gr. of wax =

$$\frac{133 \cdot 7}{133 \cdot 7 - (-5 \cdot 6)} = \frac{133 \cdot 7}{133 \cdot 7 + 5 \cdot 6} = \frac{133 \cdot 7}{139 \cdot 3} = 0 \cdot 9598.$$

F. J. R. C.

To the Editor of the Chemical News.

SIR,—I send you herewith particulars of two experiments, which for my own satisfaction I have made, and in case you may think them worthy of record they are at your service.

The olivine employed was in pure translucent yellow fragments from Vesuvius—the iron being common iron wire. The sp. gr. of both were determined with care.

A. Weight of some fragments of olivine, sp. gr.

$3 \cdot 19$, was $20 \cdot 33$ grs.
Do. of iron wire, sp. gr. $7 \cdot 51$ $30 \cdot 21$ "

Consequent weight of iron+olivine was .. $50 \cdot 54$ "

And the sp. gr. of same taken together was found to be $4 \cdot 87$.

Supposing the problem put in the form proposed by *Sideros*, the formula of "F. J. R. S." would give—

Weight of iron+olivine in water =
 $= 50 \cdot 54 - (50 \cdot 54 \div 4 \cdot 87) = \dots\dots\dots 40 \cdot 17$
Deduct weight of olivine alone in water =
 $= 20 \cdot 33 - (20 \cdot 33 \div 3 \cdot 19) = \dots\dots\dots 13 \cdot 96$

Gives weight of the $30 \cdot 21$ grs. iron in water = .. $26 \cdot 21$

and $30 \cdot 21 \div (30 \cdot 21 - 26 \cdot 21) = 7 \cdot 55$ sp. gr. of iron required.
According to "Lloyd's" formula.—

$$\frac{3 \cdot 19 \times 4 \cdot 87 \times 30 \cdot 21}{(3 \cdot 19 \times 50 \cdot 54) - (4 \cdot 87 \times 20 \cdot 33)} = \frac{469 \cdot 321413}{62 \cdot 2155} = 7 \cdot 54 \text{ sp. gr. of iron required.}$$

B. Another experiment gave following results :—

Weight of olivine of sp. gr. $3 \cdot 20$ employed = .. $20 \cdot 32$
" of iron " $7 \cdot 87$ " = .. $33 \cdot 55$

Total weight of iron+olivine being $53 \cdot 87$

The specific gravity of which conjointly was $5 \cdot 09$. As before "F. J. R. S's." formula gives—

Weight of iron+olivine in water =
 $53 \cdot 87 - (53 \cdot 87 \div 5 \cdot 09) = \dots\dots\dots 43 \cdot 29$
Deduct weight of olivine alone in water =
 $= 20 \cdot 32 - (20 \cdot 32 \div 3 \cdot 20) = \dots\dots\dots 13 \cdot 97$

Gives weight of the $33 \cdot 55$ grs. iron in water $29 \cdot 32$

And $33 \cdot 55 \div (33 \cdot 55 - 29 \cdot 32) = 7 \cdot 93$ specific gravity of iron.
Or by "Lloyd's" formula—

$$\frac{3 \cdot 20 \times 5 \cdot 09 \times 33 \cdot 55}{(3 \cdot 20 \times 53 \cdot 87) - (5 \cdot 09 \times 20 \cdot 32)} = \frac{546 \cdot 46240}{69 \cdot 9552} = 7 \cdot 81 \text{ sp. gr. of iron.}$$

The difference being probably in part at least due to errors of observation. D. F.

MISCELLANEOUS.

The British Association.—The official programme of the 37th annual meeting of the British Association at Dundee has just been issued. It furnishes the following details :—The Royal Exchange Reading-room will be opened as a reception-room on Monday, September 2, for the issue of tickets to members, associates, and ladies, and for supplying lists and prices of lodgings, and other information to strangers on their arrival. The member's ticket contains a map of Dundee and particulars as to the rooms appointed for sectional and other meetings. For the convenience of members and associates a branch post-office (which will be available also for communication between members attending the meeting) will be opened for this occasion in the reception-room. Members and associates may obtain railway pass-tickets and information of local arrangements on application to the local secretaries at Dundee. The general committee will hold its first meeting in Panmure-street Chapel on Wednesday, the 4th September, at 1 p.m., for the election of sectional officers and the despatch of business usually brought before that body. The general committee will meet again in Panmure-street Chapel on Monday, the 9th of September, at 3 p.m., for the purpose of deciding on the place of meeting in 1868. The concluding meeting of this committee will also be held in Panmure-street Chapel, on Wednesday, the 11th of September, at 1 p.m., when the report of the Committee of Recommendations will be received. The first general meeting will be held in the Kinraid Hall on Wednesday, September 4, at 8 p.m. precisely, when Mr. W. R. Grove, Q.C., M.A., F.R.S., &c., will resign

the chair, and his Grace the Duke of Buccleuch, K.G., F.R.S., &c., will assume the presidency and deliver an address. The different sections will assemble in the rooms appointed for them for the reading and discussion of reports and other communications, on Thursday, September 5; Friday, September 6th; Saturday September 7th; Monday, September 9th; and Tuesday, September 10th, at 11 a.m. precisely. The sections are the following:—A.—Mathematical and Physical Science—In the High School. President, Professor Sir W. Thomson, D.C.L., F.R.S., &c. Vice-Presidents, Professor Kelland, F.R.S., Mr. Clerk Maxwell, F.R.S. Secretaries, Professor Clifton, M.A., Professor G. C. Foster, M.A., Professor Swan, F.R.S.E. B.—Chemical Science—In the High School. President, Professor Thomas Anderson, M.D., F.R.S.E. Vice-Presidents, Mr. Maxwell Simpson, F.R.S., Professor Williamson, F.R.S. Secretaries, Mr. A. Vernon Harcourt, Secretary C.S., Professor Living, M.A., F.C.S., Dr. Russell F.C.S. C.—Geology—In Panmure-street Chapel. President, Mr. Archibald Geikie, F.R.S., F.G.S., Vice-Presidents, Sir Philip Egerton, F.R.S.; Professor Ramsay, F.R.S. Secretaries, Mr. W. Pengelly, F.R.S., Mr. H. Sorby, F.R.S. D.—Biology.—In the High School. President, Professor Sharpey, Secretary R.S.; Vice-Presidents, Professor Allman, F.R.S., Sir John Lubbock, F.R.S. Secretaries, Dr. Spencer Cobbold, F.R.S., Mr. H. L. Stainton, F.R.S., Rev. H. B. Tristram, M.A., F.L.S., Professor W. Turner, M.B., F.R.S.E., Mr. E. B. Tylor. E.—Geography and Ethnology.—In the Albert Institute. President, Sir Samuel Baker, F.R.G.S. Vice-Presidents, Mr. John Crawford, F.R.S., Sir Roderick Murchison, F.R.S. Secretaries, Mr. H. W. Bates, Assistant Secretary Geographical Society; Mr. Clements R. Markham, F.R.G.S.; Mr. O. W. Nash, Mr. Thomas Wright, M.A. E.—Economic Science and Statistics.—In Euclid-street Chapel. President, Mr. M. E. Grant Duff, M.P., M.A. Vice-Presidents, Dr. Farr, F.R.S.; Colonel Sykes, M.P., F.R.S. Secretaries, Professor Leoni Levi, F.S.A.; Mr. Edmund Macrory. G.—Mechanical Science.—In Watt-hall, Constitution-road. President, Professor W. J. Macquorn Rankine, LL.D., F.R.S. Vice-Presidents, Mr. W. Fairbairn, F.R.S., General Lefroy, R.A., F.R.S. Secretaries, Mr. P. Le Neve Foster, M.A. The sectional officers will be proposed for election to the General Committee on Wednesday, September 4. The following general and evening meetings have been arranged:—On Wednesday evening, September 4, at 8 p.m. in the Kinnaird-hall, the President's address. On Thursday evening, September 5, at 8 p.m., in the Volunteers' Hall, soiree. On Friday evening, September 6, at 8.30 p.m., in the Kinnaird-hall, a discourse will be delivered by Mr. Archibald Geikie, F.R.S., director of the Geological Survey of Scotland, on the Geological Origin of the present Scenery of Scotland. On Monday evening, September 9, at 8.30 p.m., in the Kinnaird-hall, a discourse will be delivered by Mr. Alexander Herschel, F.R.S., on Shower-Meteors. On Tuesday evening, September 10, at 8 p.m., in the Volunteer Drill Hall, soiree. Wednesday, September 11, concluding general meeting at 3 p.m. Excursions on Saturday, September 7, and Thursday, September 12.

The Poisonous Action of Phosphorus.—Contrary to the current doctrine that death in case of poisoning by phosphorus results from fatty degeneration of the liver, produced by phosphorous acid, M. Dybrowsky states in a recent memoir that the toxic result is entirely due to the formation of phosphuretted hydrogen gas, which in passing through the blood completely uses up the oxygen present. Hence he concludes that death from phosphorus is nearly equivalent to death by asphyxia.—*Medical Times and Gazette*.

Methylated Spirits.—After the 1st of October next the duty on licences to retailers of methylated spirits is to be reduced to 10s. per year.

Technical Education.—The following extract from *The Times'* account of the "safe contest," forms an appropriate commentary on the remarks on Technical Education in the supplement to last week's *CHEMICAL NEWS*:—"Mr. Herring's workmen were three intelligent Germans—one of them a man of marked ability—he spoke three languages—and went about his business in the most scientific way. Mr. Chatwood's men were three Lancashire men, who represented brute force rather than intellect. One of them had a wonderful touch both for power and precision; but that was the only thing remarkable in the party. Any one who saw the contest between these two sets of workmen would carry away a very vivid idea as to the nature of the race which is now being run between the manufactories of England and those of the Continent. It is an admitted fact that the Continent has made an immense stride in advance, that the progress which we in England have made in the last 15 years is as nothing compared with that which our continental rivals have made, and that it will cost us a good deal in the future not merely to hold our own, but to save ourselves from being disgracefully beaten. The chief reason which the most intelligent observers assign for this change in our position as manufacturers is to be found in the superior education of the continental workman. He has gone through a regular course of instruction at some polytechnic school, he has been trained to appreciate principles, and he brings the exercise of brain to his work. An English foreman is of another stamp. He has had no special education; he has risen from the ranks; he knows his business by rote and rule of thumb; long practice has given him a certain mechanical facility of touch, but science he has none. By the very laws of the trade to which he belongs science is in a manner forbidden to him. Science will teach him to do in an hour what hitherto has occupied him two hours. This science is expressly forbidden him, because it would interfere with the wages of his comrades and take the bread out of their mouths."

Silicates of Methyl.—C. Friedel and J. M. Crafts, first tried to prepare this body by reacting on methylic alcohol with chloride of silicium; like Ebelmen, they obtained a product impossible to purify, turning brown in the air and possessing a foetid odour. They noticed that this product always contained chlorine. Wood spirit was purified by treatment with chloride of calcium; the chloride of calcium compound decomposed with water, and the alcohol rectified several times with sodium. The alcohol thus prepared was sealed in a tube with silicate of ethyl, and the mixture heated during 20 hours at 210° C. After several fractional distillations the principal product isolated from the contents of the tube was a liquid boiling at 143° to 147°. This liquid gave on analysis numbers which correspond with the composition of a mixed silicate, diethylic, dimethylic, silicic ether. There being reason to believe that a minute trace of water contained in the methylic alcohol interfered with the success of the processes in which it was employed, this alcohol was distilled twice with sodium, then with a small quantity of anhydrous phosphoric acid. Thus prepared, it boils at 65.5°, has not the disagreeable odour it usually has, smells like common alcohol, and does not turn brown with soda. Methylic alcohol purified in this way, when added to chloride of silicium, reacts like ordinary alcohol. When the theoretical quantity of the alcohol has been added, the product is distilled, and after a small number of fractional distillations two principal products are obtained, one boiling at 120° to 122°, and the other at 201° to 202.5°. The first is the normal silicate of methyl; the second is the hexamethylic disilicic ether. The normal silicate of methyl is a colourless liquid, has rather an agreeable odour, is soluble in a considerable quantity of water. Moisture or aqueous alcohol gives rise to condensed products, ultimately silica. It burns with a white smoke composed of silica.—*Silliman's Journal*, May, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. May 20, 1867.

BOUSSINGAULT, "On the Effects of Mercury Vapours on Plants." LIEBIG, "On Artificial Milk for Infants." GUYON, "On the Effects of the Sting of the Scorpion." F. TEYNARD, "On the Calculation of the Numerical Elements of a Simple Achromatic Objective for Photography." NAMIASS, "On the Use of Bromide of Potassium as a Remedy for Epilepsy." C. FLAMMARION, "On a Change which has taken place in the Crater of Linnæus in the Moon." CHACORNAC, "On the same subject." J. B. BAILLE, "Researches on the Variations in the Dispersive Power of Liquids under the Influence of Heat." VELTER, "On the Effects of Silicate of Potash when applied as a Manure on the Laying of Cereals, and on the Strength of the Stems of Cereals." FRITZSCHE, "On the Solid Carbides of Hydrogen obtained from Coal." S. DE LUCA, "Analysis of Water from a Bronze Vase discovered at Pompeii." M. PERRET, "An Improved Wine Fermenting Vat." A. BECHAMP, "On Pasteur's Memoir on the Corpuscles of the Silk Worm Disease." "Some new Facts on the present Silk Worm Disease, and on the Nature of the Vibrating Corpuscle." BALBIANI, "On the Supposed Reproduction by Fission of the Corpuscles or Psorosperms of the Silk Worm Disease." E. CYON, "On the Influence of Carbonic Acid and Oxygen on the Heart."

May 27.

T. GRAHAM, "On the Occlusion of Hydrogen Gas by Meteoric Iron." J. FOURNET, "On the Path of Storms in the Department of the Rhone." P. DESAINS, "Researches on the Absorptive Action of Ether and Formic Ether and their Vapours on the Heat radiated from a Lamp furnished with a Glass Chimney." A. WURTZ, "On the Synthesis of Methyl-Allyl." C. MENE, "An Analysis of some Crystallized and Amorphous Graphites." D. DE LUCA, "On the Use of Crystallized Sulphate of Soda for restoring the Transparency of the Cornea." HULOT, "On the Use of Aluminium Bronze for making the lower Die of Machines for Perforating Postage Stamps." H. DEVILLE, "On Hulo's Improved Hard Solder, formed by mixing Zinc-alumagum with ordinary Solder." "On the Rapid Oxidation of Alloys of Lead and Platinum when exposed to the Air." E. DUCLAUX, "On a Hydrate of Bisulphide of Carbon."

June 3.

E. BECQUEREL, "Notice of the Author's Work on 'Light, its Causes and Effects.'" L. PASTEUR, "Two Letters to Dumas on the Silk Worm Disease." A. SECCHI, "Resumé of Observations on Sun Spots for the first Six Months of the year 1866." "On the reported Disappearance of the Crater of Linnæus in the Moon." J. CHAUTARD, "Researches on the Magnetism and Diamagnetism of Gases." J. ROSENTHAL, "On Phenomena observed in Cases of Poisoning by Strychnine." LE RIQUEUR DE MONCHY, "On the Use of Creosote in the Rearing of Silk Worms."

NOTES AND QUERIES.

Manufacture of Size.—Can any of your readers inform me how to manufacture size used for sizing woollen warps, or if there is a treatise on it in any chemical work?—J. MORGAN.

Picric Acid.—Sir,—I can give your correspondent "S. R." all the particulars he wants concerning the manufacture of picric acid. You can give him my name and address, if, at the same time, I have his.—B.Sc.

Platinum Metals.—Sir,—On dissolving some waste shreds of platinum I found that a small quantity was insoluble. It was in fine powder with perfect metallic lustre. Can any of your correspondents kindly inform me what it is likely to be?—C. R. N. B.

Preservation of Crystals.—Sir,—If any brother reader of the CHEMICAL NEWS will inform me of a convenient way to preserve fine crystals of efflorescent substances, and salts which change on exposure to the air, he will confer a favour on—CASSIO.

Tannate of Alumina.—Sir,—Is tannate of alumina formed by adding gall liquor to acetate of alumina, settling and filtering? If your correspondent "Efra" wants it for the aniline colours, he will find it to give a good lake by adding the colouring matter to the acet. alumina and precipitating with galls.—C. A.

Dyeing Black.—Sir,—Will you kindly solve me a problem that has troubled me long? Among other things I manufacture inks, and I always find black ink settle a good deal after standing 3 or 4 weeks, in fact, till it is almost clear. One purpose for which I use it is for inking cloth, and I require it to have a thickish body, but not to appear glossy, as when gum is put in, and also to dye cotton in the cloth and appear of a good blue colour. This is my formula:—Bruised galls, 20lbs.; chip logwood, 10lbs.; aqua, 33 galls.; boil 7 hours, strain and add copperas, 4 ozs. to the gallon. Do I put too much iron, or too little, or what is it that causes it to settle? Could you either give me a better formula, or tell me how to improve mine so as to be of a middling thickness and a bluish colour? If you will, I shall ever be thankful to you for so doing.—BICHROME.

Prevention of Dry Rot.—Sir,—As an architect I have felt very much interested in the statement made by Mr. G. Lunge in your paper of the 21st June, as to the use of tank waste for the prevention of dry rot, and should much like to give it a trial. But I do not quite understand from Mr. Lunge's letter as to whether the waste is to be in direct contact with the timber, or whether it is to be spread on the ground under it. I should be glad, also, to learn how the waste is to be obtained. He would, perhaps, kindly point out one or more alkali works at the east end or other parts of London.—T. H. L.

Specific Gravity Problem.—Sir,—Your correspondent "C. H. P." before writing of the "radical errors" in the observations of others, should be careful to be accurate in his own communications. He has evidently very confused ideas as to the relations between the weight of water equal in bulk to the weight in water of, and specific gravity of, a substance. I think the subjoined is a somewhat simpler solution of the problem in question than those of "F. J. R. C." and "Lloyd," the discrepancy between the three results being due to the difference in the number of decimal places used, and to error in "Lloyd's" calculation.

Weight of water equal in bulk to compound = $50 \div 6.1 = 8.1968$

Weight of water equal in bulk to olivine = $20 \div 3.2 = 6.2496$

Subtracting we obtain—

Weight of water equal in bulk to iron = 1.9472

Specific gravity of iron = $30 \div 1.9472 = 15.406$

As this is about double the true sp. gr. of iron, I assume that *Sideros* has, for the sake of simplicity, given a supposititious example.—

HENRY MATTHEWS, F.C.S.

Specific Gravity Problem.—Sir,—The different solutions of the above problem must have puzzled *Sideros* almost as much as the problem itself. In that furnished by "C. H. P." "there is some radical error," he having mistaken the weight of an equal bulk of water for that of the body in water, as will appear on comparing his calculation with that of "F. J. R. C." The discrepancy between "F. J. R. C.'s" result and my own is caused by his disregard of decimals beyond the 1st or 2nd place. The remarks with which "C. H. P." was pleased to preface his solution are, as it happens, quite *apropos*, for 15.458 is an even more preposterous specific gravity than the one which he gives. I should imagine that *Sideros*'s specimen of meteoric iron was composed of about 10 grains of olivine and 40 of pure iron, as those numbers will give a more nearly correct specific gravity (7.87) for the iron.—LLOYD.

Specific Gravity Problem.—Sir,—Only this moment returned from the Continent, I have not seen either of your two last numbers before to-day, and hasten to correct a mistake, doubtless of my own. The sp. gr. of the meteoric iron should have been stated at 4.9, not 6.1. For this I must apologise.—SIDEROS.

Naphtha.—Sir,—The emphatic "no doubt" of your correspondent who replies to the query put in No. 399, is somewhat amusing. The same idea had lurked in my mind for a long time, but I found it wouldn't fit. I can't quote Chaldaic, but we are most distinctly told that naphthali (not naphthalin) means "my wrestling" (Gen. xxx. 8). This son of Jacob was born at least 350 miles from the Caspian Sea, and it is certainly something new in Scripture history to be told that the tribe inhabited its shores, when it is quite well known their inheritance was much further distant than even this, viz., north and west of the Sea of Galilee! (See Joshua xix. 32-39). I venture to suggest that between the words naphtha and naphthali there is no connection whatever.—W. BRIGGS, Naphtha Distiller.

TO CORRESPONDENTS.

Engineer suggests that some boiler explosions may be caused by the annular discharge of steam, sometimes attracting the safety valves to their seats, and thus obstructing the escape; in the same way that a strong blast of air discharged from a pipe within a short distance of a flat surface, will not repel, but will attract any object placed in the intervening space.

F. H.—The vapour of bisulphide of carbon, constantly inhaled, is said to produce temporary insanity amongst workmen.

B. R., U.S.A.—The metal erbium certainly seems to be an elementary body, and not a mixture of yttrium and didymium. Few chemists have worked on the subject, owing to the rarity of the minerals containing these earthy bases.

Quasitor asks where stoneware vessels capable of holding 1,000 gallons can be had of the best quality, capable of resisting the action of strong commercial hydrochloric acid at 200 to 300°F. He cannot do better than apply to Messrs. Cliff and Co.

Communications have been received from J. Collins (with enclosure); H. W. Kearns, B.Sc.; G. Davies; R. H. Clark (with enclosure); H. Hudleston; W. A. Wood; G. Croome; A. Bird (with enclosure); L. Dourrieu; E. Elliott; J. Ayling; A. Hofmann; E. O. Jones; John M. Swinstead (with enclosure); J. Schad (with enclosure); C. Littleton; S. Hingley; C. R. C. Tichborne (with enclosure); F. J. R. Carulla (with enclosure); S. W. Moore (with enclosure); E. James; P. J. Butler; D. Forbes, F.R.S. (with enclosure); J. Landauer; Arthur C. Bowdler; H. R. Marsden (with enclosure); L. Power (with enclosure); C. Crump; R. C. C. Lippincott; J. Slesor (with enclosure); Dr. C. P. Bahin; W. Briggs; James Smith; John R. Irvine; Peter Squire.

Books Received.—"On the Practice of Employing certain Substitutes for the Genuine Ingredients in some Articles of Daily Food," by a LADY.

THE CHEMICAL NEWS.

VOL. XVI., No. 404.

ANALYSIS OF BLISTER STEEL.

By DAVID FORBES, F.R.S., &c.

VERY few analyses of blister steel are to be met with in any of the treatises on metallurgy, and even in Dr. Percy's recent work on the metallurgy of iron and steel, no analysis is to be found of this truly national product. Under these circumstances therefore, the following analysis of blister steel converted in Sheffield from bar-iron of Swedish manufacture, may be considered as worthy of being recorded.

In making this analysis the portion selected for examination was obtained in a sufficiently divided state by chipping off the bar with a cold chisel, since it was found that no reliance could be placed in filings, which even if produced by the best files were always largely contaminated by the debris of the file itself; the determination of the constituents was made as follows:—

Determination of the total amount of Carbon.—77·91 grains of the steel in the form of such chippings, were allowed to remain (about ten days) in a cold solution of 200 grains pure chloride of copper, until no undissolved steel remained behind; the residue was then well washed by decantation, dried, mixed with 100 grains of pure oxide of copper, and burnt in a current of purified dry oxygen gas, at a heat sufficient to soften the Bohemian glass tube. The carbonic acid collected as usual in a potash apparatus, amounted to 2·08 grains, or equivalent to 0·729 per cent carbon in the steel.

Determination of the Sulphur.—107·58 grains were placed in a flask provided with a safety-funnel, and digested (for twenty-four hours) in the cold with strong hydrochloric acid; the gas evolved was passed through a solution of pure chloride of zinc supersaturated with ammonia; the iron being all dissolved, the zinc solution was boiled with nitric acid in some excess, nearly neutralised by ammonia to prevent any solvent action from excess of acid, and precipitated by a solution of pure chloride of barium,—0·04 grains sulphate of barytes were obtained, equivalent to 0·005 per cent sulphur in the steel.

Determination of the Silicon and uncombined Carbon.—The solution from above was evaporated in a water-bath to dryness, re-dissolved in water with some hydrochloric acid, and filtered from the insoluble silica and graphite; these latter were washed off the filter into a silver basin, in which they were boiled with potash, which dissolved out the silica, leaving the graphite, which was collected on a filter, washed, dried, carefully scraped off filter, and after drying at 250° F., weighed 0·11 grains, equivalent to 0·102 per cent uncombined or graphitic carbon. The potash solution of silica was supersaturated with hydrochloric acid, evaporated to dryness, and the residue treated with water rendered acid by hydrochloric acid. The silica was then filtered off and determined as usual, being 0·06 grains, or equivalent to 0·0304 per cent silicon in the steel.

Determination of the Manganese.—The acid filtrate, after separating the graphite and silica by filtration, was now nearly neutralised by ammonia, and then treated with carbonate of barytes in excess, filtered, and the filtrate precipitated by sulphide of ammonium, the sulphide of manganese mixed with some sulphate of

barytes was then treated with weak sulphuric acid, filtered, and the manganese precipitated by carbonate of soda as usual, affording 0·18 grains manganosomanganic oxide, or equivalent to 0·12 per cent manganese in the steel.

Search for Phosphorus.—52·75 grains of the steel treated precisely according to Abel's directions (CHEMICAL NEWS, vol. vi. p. 133), afforded no trace of ammoniac phosphate of magnesia. 73·28 grains examined by Spiller's process (CHEMICAL NEWS, vol. xiii. p. 170), gave the same negative result; and, lastly, 48·07 grains tested by Eggertz's method by molybdate of ammonia, did not afford any trace of phosphorus.

Determination of Iron.—The amount of iron present was estimated as loss. The percentage results will be as follows:—

Carbon combined	0·627
———— graphitic	0·102
Silicon	0·030
Phosphorus	0·000
Sulphur	0·005
Manganese	0·120
Iron	99·116
	100·000

ON THE USE OF POTASSIC CHLORATE IN QUALITATIVE BLOWPIPE EXPERIMENTS.

By JOHN LANDAUER.

I communicated in No. 399 of the CHEMICAL NEWS, as the result of many experiments, a method of detecting manganese by means of potassic chlorate and the blowpipe.

I have continued these experiments, and convinced myself that this salt may be used with advantage for the detection of many oxides by means of the blowpipe, inasmuch as it leaves nothing to be desired as regards readiness and delicacy of execution. The delicacy of the test especially is greatly augmented by the fact, that the originally white salt assumes the respective colours.

The action of the potassic chlorate is, of course, that of energetic oxidation, caused by the evolution of oxygen at a high temperature. I find it most convenient to employ glass tubes, not too thick, in dimensions of about 15 centimeters long by 5 millimeters in width, and closed at one end; in these is introduced a small quantity of the chlorate, together with the substance to be examined; heat is applied gradually, at last with the help of the blowpipe, until no more oxygen is given off. The reaction is then completed, and the colour of the flux is examined.

I give in the following table some of the more delicate reactions, reserving a more complete investigation, the results of which will shortly be published in this journal:—

Iron	Flesh colour
Lead	Yellowish brown
Copper	Black or greyish black
Cobalt	Blue (in certain cases black),
Manganese	Purple
Nickel	Black (Ni ₂ O ₃).

The Director of the Paris Mint.—M. Dumas, chemist and senator, has been appointed to succeed the late M. Pelouze as Director of the *Commission des Monnaies* of Paris. M. Dumas had previously resigned his appointment of professor in the faculty of science in the University of Paris, and inspector-general of the high schools of France.

ON THE
UTILISATION OF THE WASTE PRODUCTS
OF THE MANUFACTURE OF COAL GAS.

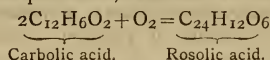
By DR. LETHEBY.

(Continued from page 96).

Carbolic Acid Colours.

Four or five dyes have already been produced from this compound, namely, *rosolic acid* or *aurine*, *peonine* or *coralline*, *azuline*, and *picric acid*.

Rosolic acid is contained in coal-tar, as was first demonstrated by Runge in 1834, who extracted it from the dark red-brown residual product of carbolic acid by means of spirit; and on treating the solution with caustic lime, he separated a brown compound (brunolate of lime), and obtained a red solution (rosolate of lime), from which he precipitated the *rosolic acid* as a dark red powder by the aid of acetic acid. Other observers, as M. Tschelnitz in 1857, and Dr. Hugo Müller still later, noticed that the common carbolate of lime of commerce became red on exposure to the air, and that this was due to the formation of rosolate and brunolate of lime; but we are indebted to Dr. Angus Smith, and more recently to M. Jourdan, for an explanation of the changes which thus take place in carbolate of lime, and for suggestions for a process for making the dye on a commercial scale. They found that when the vapour of carbolic acid is passed over a hot mixture of soda and peroxide of manganese, or peroxide of mercury, oxygen is absorbed and *rosolic acid* produced, thus:—



The residue yields to water a rich solution of rosolate of soda, from which the *rosolic acid* can be obtained by precipitating by means of acetic acid.

The production of acid commercially has been accomplished and patented by Messrs. Guinon, Marnas, and Bonnet. They mix together about 23 parts, by weight, of carbolic acid, 10 to 20 of oxalic acid, and from 7 to 14 of commercial sulphuric acid, and heat them for three hours or until the desired colour is obtained. The product is well washed with water to remove the excess of acid, and the residue, which is impure *rosolic acid* (*aurine*), is a soft pitchy material with a green shade of cantharides; but as the acid is insoluble in water and cannot well be fixed upon fabrics, the patentees have converted it into a new compound, named *peonine*, by incorporating nitrogen with it.

Peonine or *coralline* is produced by heating 1 part of the *rosolic acid* with 2 parts of ammonia of commerce, for three hours, in a closed metallic vessel at a temperature of 270° Fahr. The product is a thick liquid of considerable tinctorial power, and which gives with acids a deep red insoluble or fast colour, which may be so applied to silk, wool, and other textile fabrics.

Azuline, as I have already stated, is a blue colour, produced by heating 5 parts of *peonine* with 6 or 8 of aniline, and keeping them at nearly the boiling-point for several hours.

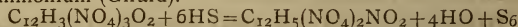
Picric acid, or *carbazotic acid*, or *trinitrophenic acid*, is obtained by oxidizing carbolic acid with nitric acid. It was formerly procured by a like treatment of indigo and the yellow resin (*Xanthorrhoea hastilis*) of Australia, and also by the action of nitric acid upon the coal naphtha which distils between 300° and 400° Fahr.

When carbolic acid is cautiously dropped into strong nitric acid it is attacked with great violence and with a hissing noise, as you may observe; and, according to the strength of the acid, there are produced one or more of the following substitution compounds:—

Carbolic acid	...	...	...	...	$C_{12}H_6O_2$
Mononitrophenic acid	...	...	...	...	$C_{12}H_5NO_4O_2$
Binitrophenic acid	...	...	...	...	$C_{12}H_4(NO_2)_2O_2$
Trinitrophenic acid	...	...	...	...	$C_{12}H_3(NO_2)_3O_2$

If the acid be strong enough the last compound is alone produced, and when the mixture cools it deposits crystals of picric acid. These are purified by dissolving them in water, neutralising the solution with carbonate of soda, evaporating, and crystallizing. The crystals of the soda salt yield, when they are decomposed with dilute sulphuric acid, fine yellow, pearly looking crystals, or plates of picric acid. They are soluble in from 80 to 90 parts of cold water, and they possess considerable tinctorial power—a grain of acid in 300,000 grains of water will give a moderate shade of yellow to 1000 grains of silk. The colour is best applied with a mordant of alum and cream of tartar; cotton fabrics do not retain the colour, and hence it becomes a test for such tissues when mixed with wool or silk. The solution is very bitter, and, as it is not a poisonous compound, it has been thought that it might be used instead of hops for beer. It forms yellow salts with the alkalies, and with metallic oxides, and most of them are highly fulminating or explosive when heated.

If picric acid is submitted to the action of reducing agents it produces red colours of great beauty; thus *picramic acid* is formed when the acid is reduced by means of a hot solution of protosulphate of iron (Wöhler), or by the aid of sulphuretted hydrogen or sulphide of ammonium (Girard).



Picric acid.

Picramic acid.

The acid thus obtained is in the form of brilliant ruby-red crystals, which are soluble in alcohol and ether, and slightly soluble in water.

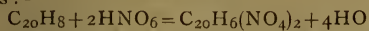
Isopurpuric acid is another red product of picric acid. It is procured from it by the process of M. Hlasiwetz, which consists in dissolving 2 parts of cyanide of potassium in 4 of water, and when it is heated to a temperature of 140° Fahr., adding little by little a solution of 1 part of picric acid in 9 of water. The liquid evolves ammonia and prussic acid, and, on cooling, deposits an abundant crop of crystals. These are washed with a little cold water, and then dissolved in boiling water to which a little carbonate of soda has been added; as the solution cools it yields tolerably pure crystals of isopurpurate of potash. They have a red-brown colour by transmitted light, and a green metallic by reflected. By substituting ammonia for potash, as by dissolving the crystals in boiling water and adding sal-ammoniac, there are formed, as the solution cools, beautiful red crystals of isopurpurate of ammonia, which is isomeric with the brilliant red dye called *murexide*, and which, but for the cheaper forms of aniline colours, would have been an important dye; for it gives to silk and wool, when mordanted with corrosive sublimate, a magnificent purple rivaling the purple of Tyre; and with a mordant of zinc it produces a brilliant yellow. The colours are very fast, but they will not resist the action of the sulphurous acid so constantly found in the atmosphere of towns.

We know but little of the homologues of carbolic acid—namely, cresylic acid ($C_{14}H_8O_2$)—and the higher members of the series, which may, perhaps, be capable of yielding corresponding coloured compounds.

Naphthaline Colours

have not yet been successfully produced, although many attempts have been made to utilize it in this way; indeed, as far back as 1858, Strecker drew attention to the similitude of chloroxynaphthalic acid and the red colouring constituent of madder (alizarine), there being required only the substitution of hydrogen for the chlorine to change it into madder red; and in 1861, M. Z. Roussin announced that he had actually converted naphthalin

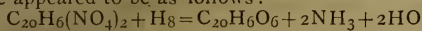
into alizarine. His process was first to act on naphthaline with nitric acid, and so change it into binitronaphthaline, thus:—



Naphthaline.

Binitronaphthaline.

This is a crystalline body, which he next dissolved, little by little, in concentrated sulphuric acid. The mixture was then heated to a temperature of 392° Fahr., and small portions of granulated zinc were cautiously added to it. After a time sulphurous acid began to be evolved, and the nitronaphthaline was slowly converted into a red colouring matter, which he thought was alizarine. The change appeared to be as follows:—



Binitronaphthaline.

Alizarine.

By diluting the mixture with 8 or 10 times its bulk of boiling water, and quickly filtering, the solution yielded as it cooled, brilliant red crystals. But they differ from alizarine in many essential particulars, especially in not giving the purple and chocolate tints, as alizarine does, with iron and alumina mordants.

Mr. Perkin has also devoted attention to this subject, but his labours have not been very successful.

Naphthalamine is a compound which bears the same relation to naphthaline that aniline does to benzole, and it is made by somewhat similar transformations. Messrs. Calvert, of the Tower Chemical Works, have produced it very largely, in the hope that, by oxidation in the same way as aniline and toluidine are oxidized, colours might be obtained. In this manner Mr. Brunner produced in Mr. Calvert's laboratory a very fine purple, by heating it with arsenic acid. M. Du Wildes obtained a like result with the nitrates of mercury; and M. Roussin has shown how fabrics may be dyed of a red colour by acting on muriate of naphthalamine with nitrite of potash, and how a violet-red tint may be obtained by heating a mixture of naphthalamine and dry bichloride of mercury in a sealed tube, at a temperature of 356°, for many hours; and by heating a mixture of muriate of naphthalamine and protochloride of tin to a temperature of 472° Fahr. The purple-red colour is in both cases insoluble in water, but soluble in alcohol, and may be thus used as a dye. Messrs. Guinon, Marnas, and Bonnet have also proposed to use it in the place of aniline for the production of a blue colour; but I am not aware that any of these processes have been put into actual practice.

And now in conclusion, as I have been compelled, for want of time, to deal very briefly and generally with this subject, I will merely state that those who are anxious to pursue the matter further will find many memoirs on the subject, to which they may refer with advantage. In this country there have been published the valuable report of Dr. Hofmann, at page 119 of the chemical section of the "Reports of Juries" on the International Exhibition of 1862, and the "Lectures by Dr. Calvert on Coal-Tar Colours, in Relation to Dyeing and Calico Printing;" and on the Continent the following have been published:—

1. "Examen des Matières Colorantes Artificielles dérivées du Goudron de Houille." Par E. Kopp. 1861.
2. "Matières Colorantes dérivées du Goudron de Houille." Par Ad. Wurtz. 1862.
3. "Manufacture and Properties of Aniline Colours, and the Bodies used in their Preparation." By MM. Depouilly Brothers. 1866. CHEMICAL NEWS, vol. xiv., pp. 77, 89, 157.)
4. "Technologie des Anilins." "Handbuch der Fabrikation des Anilins, und der von ihm derivirten Farben." M. Reimann. 1866.

In addition to which there are numerous papers on the subject in the scientific journals of the last six years, several of which have appeared, either in full or in abstract, in the *Journal of Gas Lighting*.

ON THE PRACTICAL LOSSES OF SULPHUR, &c., IN THE VITRIOL MANUFACTURE.

By CHARLES R. A. WRIGHT, B.Sc.

The following table, calculated by interpolation from Bineau's results (*Ann. Chem. et Physique*, iii. xxiv. 341), may be useful to manufacturers and others in calculating the value of sulphuric acid of a given density according to Twaddell's hydrometer, at a given temperature.

At 15 deg. Centigr.		Diminution in density for 1 deg. C. above 15 deg. C.	Percentage of SO ₄ H ₂ .	Difference for 1 deg. F.	Percentage of SO ₃	Difference for 1 deg. F.
Deg. T.	Sp. Gr.					
168.52	1.8426	0.192	100.00	..	81.63	..
168	1.840	0.191	97.00	..	79.18	..
				3.38		2.75
167	1.835	0.190	93.62	1.87	76.43	1.53
166	1.830	0.189	91.75	1.15	74.90	0.94
165	1.825	0.188	90.60	0.94	73.96	0.77
164	1.820	0.187	89.66	0.76	73.19	0.62
162	1.810	0.186	88.14	0.70	71.94	0.57
160	1.800	0.185	86.75	0.63	70.81	0.51
157	1.785	0.184	84.89	0.53	69.29	0.43
154	1.770	0.183	83.30	0.46	67.99	0.37
150	1.750	0.182	81.45	0.44	66.49	0.36
145	1.725	0.181	79.25	0.42	64.69	0.34
140	1.700	0.180	77.16	0.43	62.98	0.35
135	1.675	0.179	75.00	0.42	61.22	0.34
130	1.650	0.178	72.92	0.42	59.52	0.34
125	1.625	0.176	70.83	0.43	57.82	0.35
120	1.600	0.174	68.66	0.42	56.06	0.34
115	1.575	0.172	66.58	0.43	54.35	0.35
110	1.550	0.170	64.42	0.44	52.59	0.37
105	1.525	0.167	62.18	0.46	50.75	0.38
100	1.500	0.164	59.89	0.47	48.89	0.39
90	1.450	0.160	55.19	0.50	45.05	0.41
80	1.400	0.155	50.20	0.53	40.98	0.43
70	1.350	0.148	44.89	0.56	36.65	0.46
60	1.300	0.140	39.29	0.60	32.07	0.49
50	1.250	0.131	33.29	0.61	27.17	0.50
40	1.200	0.120	27.23	0.64	22.23	0.52
30	1.150	0.100	20.79	0.65	16.97	0.53
20	1.100	0.080	14.25	0.67	11.63	0.55
10	1.050	0.070	7.50		6.12	

The first column indicates the strength as given by Twaddell's hydrometer at a temperature of 15°C ., and the second the corresponding sp. gr.

The third shows the fraction of a degree Twaddell to be added to the observed strength for each degree centigrade that the acid is above 15°C .; or to be subtracted for each degree below 15°C .

The fourth indicates the percentage of SO_4H_2 , corresponding to the density at 15° given in the first and second columns; and the fifth, the differences between the numbers in the fourth, used for calculating the amount to be added on for fractions of a degree Twaddell.

The sixth and seventh columns indicate the quantities of SO_3 corresponding to those of SO_4H_2 in the fourth and fifth.

Thus, to find the percentage of SO_4H_2 present in acid in which a hydrometer marks $154^{\circ}5$ T. at a temperature of 25°C .

$154^{\circ}5$ T. at 25°C . correspond to $154^{\circ}5 + 10 \times 0^{\circ}183$,
or $156^{\circ}3$ T. at 15°C .

Acid at 154° T. at 15°C . contains $83^{\circ}30$ per cent of SO_4H_2
Add on for $2^{\circ}3$ T.: $2^{\circ}3 \times 0^{\circ}53 = 1^{\circ}22$ " "

Percentage required .. $84^{\circ}52$

To find the percentage of SO_3 in acid of $121^{\circ}1$ T. at 9°C .
 $121^{\circ}1$ T. at 9°C . correspond to $121^{\circ}1 - 6 \times 0^{\circ}174$, or
 $120^{\circ}06$ at 15°C .

Acid of 120° T. at 15°C . contains $56^{\circ}06$ per cent of SO_3

Add on for $0^{\circ}06$: $0^{\circ}06 \times 0^{\circ}35 = 0^{\circ}02$

Percentage required .. $56^{\circ}08$

As acid of high specific gravity is more likely to contain lead sulphate, as the effect of temperature in altering the density is greater the stronger the acid, and as there is but little difference in density for a considerable difference in per-centage with strong acid, it is evident that the amount of SO_3 or SO_4H_2 , can only be approximately determined in strong acid by the aid of the hydrometer; taking also into consideration the fact that glass hydrometers, as usually sold, are rarely correct to within $0^{\circ}5\text{T}$., and are frequently more erroneous, it may be pretty safely stated that the value of any acid of above 160°T cannot be estimated at all accurately by the hydrometer.

The amount of acid theoretically obtainable from any given ore is readily calculable by the following simple formulæ:—

From one part of sulphur ore containing x per cent of sulphur there is theoretically obtainable—

(1) of acid containing m per cent of SO_4H_2

$$2.5 \times \frac{x}{m} \text{ parts.}$$

(2) " " " " SO_3

$$3.0625 \times \frac{x}{n} "$$

Thus from a kilogramme of ore at 32 per cent of sulphur there is theoretically obtainable of acid at 135°T . (containing therefore $75^{\circ}00$ per cent of SO_4H_2)

$$2.5 \times \frac{32}{75} \text{ kilograms.} = 1.067 \text{ kilograms.}$$

and from a kilogramme of pure sulphur there is obtainable of acid at 154°T . (containing 68 per cent of SO_3)

$$3.0625 \times \frac{100}{68} \text{ kilograms.} = 4.504 \text{ kilograms.}$$

Chemical Laboratory- St. Thomas's Hospital, S.

Meetings to be held next week at Dundee.—The annual general meeting of the Ray Society will be held at Dundee (during the meeting of the British Association), on Friday, September 6; the British Pharmaceutical Conference will also hold its usual annual meeting during the Association week.

ON THE ABSORPTION OF GASES BY CHARCOAL.

THE following letter from Dr. R. Angus Smith, F.R.S., to Dr. J. P. Joule, F.R.S., has been forwarded to us:—

"My Dear Joule,—You asked me about my experiments on the absorption of gases by charcoal. I certainly seem to delay them, but I have little spare time. In 1848 I illustrated the oxidising power of porous bodies, referring chiefly to sand. In 1862, when speaking of the absorption of gases by charcoal, I ventured to say that the physical and chemical action could not be separated. I have been anxious to obtain more direct evidence.

"I had worked a good deal with the mixed gases, but lately thought it better to return to the simple, although unwilling to question results got by others. Five of these gases have been tried, and they are found to be absorbed by charcoal in whole volumes, and not in fractions of a volume, hydrogen being taken as one. In three cases hydrogen, oxygen, and carbonic acid, the numbers are 1, 7.99 and 22.05, extremely exact volumes, with a relation the same as our ordinary atomic weights. Saussure's numbers treated thus give 5.3 and 20, that for nitrogen being 4.2.

"It is only by taking the average of many experiments that these results have been obtained, but, in doing so, every one has been added without selection. The numbers from which the averages are obtained diverge so much that I suppose others have not thought of obtaining anything definite. This is caused by the difficulty of finding perfectly uniform charcoal.

"I have not found the other numbers to be the same as the equivalents, although still whole. Equivalents promise here to enlarge their bounds. I cannot believe that these numbers can be the results of any accident. They must be distinguished from chemical equivalents by weight.—I am, yours, &c.

"Manchester, June 17th, 1867."

R. ANGUS SMITH.

REPORTS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

July 18th, 1867.

J. B. DANCER, F.R.A.S., *President of the Section, in the Chair.*

"Some Further Observations on the Cause of Rotation in the Cells of *Vallisneria*," by JAMES G. LYNDE, F.G.S., F.R.M.S.

In a paper read by me at a meeting of the Section on the 16th February, 1863, "On the Action of Magenta Dye upon Vegetable Tissue," I described a series of experiments upon cuttings of *Vallisneria*, made chiefly with a view to ascertain, if possible, the cause of the rotation of the chlorophyll vesicles within the cells.

I then concluded that the rotation was due to the action of cilia on the inner surface of the cell wall, and was confirmed in this opinion not only by the appearance of the luminous stratum or so-called ciliary wave which had been observed by Dr. Branson, Mr. Wenham, and others, but also by the appearance on the cell walls of certain markings revealed by the action of the dye on the suspension of the vital action.

The above experiment was exhibited to the Section, and many of the members present attributed these markings, as I had done, to the presence of cilia.

I have since, from time to time, pursued my experiments on the subject, in the hope that I might be able to

adduce more positive evidence as to the cause of the wave of light on the interior of the cell wall.

After many fruitless experiments I at length determined to try the effect of polarized light, and on the application of it with a $\frac{1}{4}$ -inch objective, having an aperture of 130° to 162° , and so arranging Darker's series of selenite plates as to give a dark blue ground, there appeared over the surface of all the cells brilliant gold-coloured scintillations which had all the appearance of cilia in motion.

The portion of leaf under examination exhibited very sluggish circulation, and was therefore in a very favourable state for the observation.

I have since repeated the experiment several times, and have never failed witnessing the same appearance.

Notwithstanding all that I have seen I cannot say that I am convinced the appearances can be attributed to nothing else but cilia; it is possible they may be due to the presence of active corpuscles, as suggested by Mr. Wenham in his paper on the leaf cells of *Anacharis alinastrum* published in the *Microscopical Journal* for 1855, which corpuscles may be *Vibronia* or *Zooglæ*, described by Dr. Cohn in his "Researches on the Development of the Microscopic Algae and Fungi," as representing the developmental condition of a plant, but it is only by further research that this point can be definitely settled.

The result of my observations so far appears to be that in addition to the wave of light already seen, the separate objects causing that wave may now be observed in the manner I describe; what these objects are is still a matter to be determined, but at present I am inclined to believe them to be cilia on the cell wall, while at the same time there are also independent moving corpuscles within the cell; some of these bodies have the appearance of crystals, and in one specimen I observed a great number of starch granules in the cells.

In investigating this subject the smallest step in advance cannot but be deemed of importance, and I trust that in giving the results of my observations as they occur, I may be the means of saving time and trouble to others who may be investigating the same class of objects, and of inducing them to follow up so interesting a subject, as it is only by many and independent observations the truth can be ascertained.

For the information of members I may state in detail the method of observation I have found most successful.

The microscope I made use of is one of Smith and Beck's largest sized binocular, with one of Beck's most recent $\frac{1}{4}$ -inch objectives.

The illumination was by means of an Argand gas burner, the light passing into a right-angled prism below the stage in a line with the axis of the object glass.

Immediately beneath the stage was the achromatic condenser, used both with and without the central stop in the diaphragm, the object being seen equally well in both ways with different effects of light.

Below the achromatic condenser was fixed Darker's series of selenites, and below this the polarizing prism, the analysing prism being inserted immediately above the objective.

I made use of the low Huyghenian eye-pieces and used the microscope either as a binocular or single tube, the field being well illuminated in each case.

I need not add that the most careful centering and adjustment are essential.

In preparing the object I made a section of a small portion of the leaf laid on a piece of cork in water under a simple microscope, separating only one layer of cells; I laid this on a slip made of thin covering glass, and over it applied a thin glass cover, a small feeding bottle and thread being made use of to prevent the object being dried by evaporation.

I then covered the stage and object with a piece of black velvet, to prevent interference from other lights in the room.

BRITISH MEDICAL ASSOCIATION,

TWENTY-FIFTH ANNUAL MEETING, 1867, HELD IN DUBLIN.

IN a paper entitled, "*Mode of Detecting Impurities in Tetrachloride of Carbon*," read in the Midwifery Section, Dr. Protheroe Smith observed, that previous to the publication of his account of this anæsthetic in the numbers of the *Lancet* of last June, there were few if any pure specimens of the tetrachloride to be obtained. To this circumstance he attributes the contradictory conclusions which in some instances had been arrived at by those who had experimented with the tetrachloride. After studying concisely its physical and chemical properties, Dr. Protheroe Smith remarked that the chief cause of the failures above mentioned were the three following impurities:—

I. *Bisulphide of Carbon*.—This is easily detected by evaporating over a spirit-lamp a portion of the suspected fluid in a deep cup, when, if it contains bisulphide, a slightly bluish flame will appear, whereas if free from this impurity it would be entirely unflammable.

II. *Free Sulphur*.—Should such exist, after spontaneous evaporation of some of the tetrachloride on a watch-glass, a fine opaque film will remain, which when heated would give off the well-known fumes of sulphurous acid.

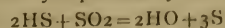
III. A peculiar sulphur-compound, which is discovered by dipping in the suspected fluid some clean blotting-paper, which when dry will give a peculiar unpleasant smell of dirty linen.

Dr. Protheroe Smith also exhibited his inhaler. It consists of a graduated glass receiver for the anæsthetic, with a tube in its centre, by which at every inspiration air passes first through the fluid, and then through the sponge, thus becoming so highly charged with its vapour as very rapidly to induce anæsthesia.

This mode of administering anæsthetics effects a salvage of from $\frac{1}{4}$ to $\frac{1}{2}$ of the fluid, so that a drachm may go as far as an ounce when employed as ordinarily on a handkerchief. Dr. Protheroe Smith entered more fully into the comparative merits of tetrachloride of carbon and chloroform in an animated discussion on the action of anæsthetics which took place in the Midwifery Section on Friday afternoon, when Sir James Simpson called upon him to give his experience. Some of the advantages claimed for tetrachloride of carbon were that its administration is rarely followed by sickness or other derangement of health,—that it does not seem to interrupt the natural efforts of labour as often observant with chloroform,—that its effect upon the perceptive faculties very rapidly ceases,—that it can be made at much less cost than any other anæsthetic,—that a smaller quantity suffices for use, and for many other medical reasons which were given.

Dr. Smith's tetrachloride is evidently made by passing the vapour of bisulphide of carbon and chlorine through a red-hot tube. There is no doubt that this compound can be procured very cheaply by this method, and that ultimately it will be used in the arts; much of the so-called tetrachloride, however, now met with is procured by the action of chlorine upon chloroform, and is frequently a mixture of chloroform, other chlorides of carbon, and the tetrachloride.

Sulphurous Acid and Hydric Sulphide.—S. de Luca and T. Waldini. The mutual decomposition of these two bodies is not correctly expressed by the equation:



for the formation of pentathionic acid is observed during the reaction, which, however, decomposes again, setting free sulphur. The sulphur, liberated, appears in two modifications, of which one is soluble in carbonic disulphide, the other insoluble.—(*Comptes R.* lxiv. 1200).

FARADAY.

A truly great man is, alas! gone from among us, and a man, moreover, whose place cannot be filled. We have great chemists, and great physicists left, but we have not, and probably never shall again have, a Faraday.

It is not often given to the world to possess a man so nearly without a blemish, either in his morals or his intellect,—it is still less often given to the world to possess a man of whom all men speak well. In this respect Faraday stood absolutely alone. But in how many more respects did he stand alone? A man of humble birth, and of high—the highest—aspirations, he sought no social distinctions: a man born poor, and yet who never coveted riches. He was the only man, we say, who has raised himself to the first rank in science in this country, whose every attribute we may fearlessly hold up as a model to our children! Davy had as great, certainly not a greater genius, but his vast ambition, eternal pining after rank, and his hauteur, made up an *ensemble* which it is not for us to imitate. Wollaston was as great a manipulator, and possibly a greater chemist, but his secretiveness and his coldness forbid us from entertaining even the faintest interest in him as a man. Despite the recent discoveries (?) of our French brethren, we cherish a feeling of veneration akin to awe for Newton, but there is no tinge of affection in our admiration. But Faraday's intellect, while it burnt as brightly as Davy's, was as deep searching as Wollaston's, and as reverent as Newton's, had nothing in it which could repel us, chill us, or forbid our affection.

We will not suppose for a moment that our readers are not to some extent aware of the principal incidents in the career of Faraday, but we cannot, while announcing his death, omit, in a few words, a slight sketch of his history, premising that less of it is known than we could wish; but this defect will soon be remedied, for too much cannot be known about him, and unlike most great men, he will never require a Froude to rehabilitate his name.

Michael Faraday was born in 1791, at Newington, in Surrey. His father was a blacksmith, and we deeply regret that we have no authentic record of his youth until the time he was apprenticed to a book-binder. It is certain, however, that at the time of his apprenticeship he was enthusiastically fond of science, and had even made an electrical machine and other scientific apparatus. The almost incredible skill which he had with his hands, (a skill which is born in a man, and which, in its perfection, cannot be taught), induces us to believe that he would find much less difficulty than most men in acquiring the power of using the *materia technica* of chemistry and physics; and the readiness with which Sir Humphry Davy received him as an assistant into his laboratory, is a pretty strong evidence that at that time he knew enough of chemistry to make himself exceedingly useful.

The turning-point in his career really begins with his construction of the electrical machine and apparatus to which we have alluded. His master happening to point them out to a Mr. Dance, a member of the Royal Institution, that gentleman took him to hear some lectures of Sir Humphry Davy's. The result may easily be guessed. Every one knows that there was an almost magical charm about Davy's lectures. His wonderful discoveries, his enthusiasm, his brilliant

experiments, his great reputation—if all these advantages could so enchain his audiences, that the women would fall in love with him, and send him letters, no wonder that the intellect of the noble boy was captivated and fired by them. In the purity and simplicity of his heart he thought that the priests who cherished the sacred fire were free from the meannesses and weaknesses of ordinary men.

Unhappily, scientific men are by no means what young Faraday thought them, and although science proved to him an indulgent mistress, she too often is seen as the stern goddess who can only be propitiated by the sacrifice of life; or, like the dames in the old romances of chivalry, by the performance of labours which tax the strength and courage of her votaries to the very utmost. The whole history of science is the history of a struggle for pre-eminence among its students, who, too often, take more delight in demolishing the reputation of the one man who has raised himself above his fellows, than in assisting the ninety and nine poor students who vainly appeal to them for help. The war between professors is a war to the death, and woe be to the weaker sword; and as the crusaders crammed the true faith down the throats of the unbelievers beneath the banners of the Cross, so professors slaughter each others' reputations in the gentle name of truth. As poor Mulder said of his tormentor, "It is in the name of truth that he plunges his branding iron into the fire, and it is while shouting 'truth' that he presses it on the forehead of his victim, and rejoices in the ascending vapour!"

Faraday, knowing nothing of these things, took copious notes of Sir Humphry's lectures, and forwarded them to him with a letter, in which he stated his anxiety to leave trade, and devote himself to Science, so that he might associate himself with men, who, purified by the grandeur and sacredness of their calling, were free from the littlenesses and weaknesses of other men. Sir Humphry received him kindly, and (no one being better fitted for the task) dispelled his illusions regarding the disinterestedness and simplicity of men of science. He also made him his laboratory assistant, a position for which, perhaps, no man in the world was so well qualified. This was in 1813, and for several years he worked unremittingly for Davy, who does not seem to have regarded him in any other light than as a good assistant, out of whom as much work as possible was to be got, and of whom it was expected that he should never forget the vast difference in their relative positions. Even during their stay at Paris, Davy is said to have been annoyed at the attentions that were shown to Faraday. Still, but for Davy, Faraday's progress would probably have been much slower, and there is little doubt that the prestige of being Davy's assistant was of no small value to him in his career.

What Faraday did it is not possible for us here to recapitulate. He discovered benzol, and determined the composition of naphthalin. The first discovery has led to one of the greatest industrial successes which chemistry has ever achieved, and the study of the second led Laurent to some of the most important theoretical discoveries of the age.

As early as 1820 Faraday discovered the chloride of carbon, and it is to him that we are indebted for the information that the chloride of olefiant gas is formed by the union of equal volumes of its constituents. It must not be forgotten that at the

time of this observation being made, chemists had not their present definite views about combination by volume.

In the year 1821 Faraday made his brilliant discovery of the rotation of a wire carrying an electric current, round a magnetic pole, and *vice versa*. This cardinal fact excited immense attention, and in addition to inducing him to devote himself for many years to electricity with almost unparalleled success, was the means of causing numerous investigators to pursue the same track. In 1821 he published his brilliant paper on the condensation of the gases, in which he enunciated for the first time, the important axiom (now obvious enough) that gases are, in fact, simply the vapours of volatile liquids. In 1824 he was elected a Fellow of the Royal Society, chiefly, it is said, through the influence of his unwavering friend Richard Phillips, and in spite of the unwillingness of Davy; who, however, did not take any active measures to prevent it, and whose unwillingness appears to have been of a purely passive kind.

In 1827 Faraday published the first edition of his "Chemical Manipulation." This work, which has long been out of print, is a most extraordinary proof of the versatility of the author's chemical knowledge. It shows that there was no branch of chemistry cultivated in his time with which he was not practically familiar. In it we see the key to most of Faraday's success, namely, to omit no precaution. The style in which it is written, although clear, is verbose, and far from elegant. This is the more remarkable, inasmuch as he was almost unrivalled as a lecturer, not only for clearness, but conciseness, and the power of rousing the enthusiasm of his audience.

In 1829 he was appointed Lecturer on Chemistry at the Royal Military Academy, Woolwich; and in 1833, Fullerian Professor of Chemistry in the Royal Institution. In 1839 he published the first of his three volumes of "Experimental Researches in Electricity." The second volume appeared in 1844, and the third in 1855.

In 1846 he received the Rumford medal of the Royal Society, for his discovery of the rotation of the plane of polarisation of light under the influence of magnetism; and in 1847 he announced the magnetic character of oxygen, and the relations towards magnetism of gases generally.

So long ago as 1835 he received, at the recommendation of Lord Melbourne, a pension of £300 a-year from Government.

His scientific titles were almost too numerous to recapitulate. In addition to being a member of all the Academies of Science of any note in Europe, he was a Doctor of Civil Law of Oxford, Knight of the Prussian Order of Merit, of the Italian Order of St. Maurice and Lazarus, Officer of the Legion of Honour, one of the eight Foreign Associates of the Imperial Academy of Sciences of Paris, and an Associate of the Paris Academy of Medicine.

Faraday, in addition to, and beyond all his titles, was a true gentleman. His manners were characterised by an extreme gentleness and tenderness for the feelings of others. No one could write to him for advice or assistance without receiving it, and his advice was sure to be wise and good. He was entirely free from jealousy of the scientific discoveries of others; indeed he delighted in doing justice to the merits of his scientific contemporaries.

It is pleasant to know that in 1858 the Queen gave him a residence in Hampton Court.

It would be ungrateful not to put on record a few of the personal impressions which have stored themselves in our memory, in the course of the many years during which we have had the honour and happiness of know-

ing Faraday. We have seen him at work, we have attended his lectures, we have asked his advice, we have consulted him in our difficulties, and in every position in which we have known him, he has more, far more, than realized the ideas we had formed of him.

We can speak of him in his capacity as a lecturer with more confidence perhaps than most persons, no matter how often they have heard him, for we have followed him word for word in reporting two of his courses of lectures, viz. those on the "Various Forces of Matter," and also on the "Chemical History of a Candle." His delivery was by no means rapid, and shorthand writers followed him with far more ease than they did most persons. His language was well chosen, and when surrounded by his apparatus, he seemed almost inspired. The most simple experiment in his hands told its tale so well, and, by the manner in which it was done, assumed such marvellous freshness, that we forget that we had performed it hundreds of times ourselves, and gazed upon it as eagerly as the veriest tyro in the theatre.

How valuable this gift of enthusiasm is in a lecturer we need not say; it is, as it were, contagious, and in his case at least the earnest lecturer always secured an attentive, nay, a rapt audience. To see him perform an experiment was in itself a most instructive study. A failure was with him almost a thing unknown. His readiness of resource was wonderful, and if, in the course of an experiment, an unforeseen phase developed itself, if instructive, it was commented on and turned to account as an illustration of those forces, in the delightful study of which he passed his life; if, on the other hand, the experiment took a turn which threatened to defeat the object in view, he was ready in an instant with a remedy.

A most characteristic act of Faraday was that which *Punch* (who can be serious enough at times) illustrated by a cartoon headed "Faraday presenting his card to Father Thames." Faraday, in the course of a trip in one of the London steamboats, made some very important observations on the state of the river, and, in order to acquire a tolerably exact idea of the extent to which it was polluted by solid matter, threw pieces of card into the stream, and noticed at what depth they became invisible, owing to the opacity of the water. The information thus gained formed the nucleus of a letter to *The Times*, which did more to call attention to the dangerously foul state of the river than any number of letters from less gifted and venerated writers.

We have said that no one ever asked the advice of Faraday in vain; and certainly, no more golden words were ever uttered than those in which he told to a young inquirer the secret of his uniform success; "the secret" said he "is comprised in three words—Work, Finish, Publish." It must be confessed that young chemists of the present day follow this advice, carefully omitting the second word.

Faraday was married, but, like Davy, Berzelius, and Wollaston, left no children to inherit his glorious name.

On Sunday last he died, and it will, indeed, be long before we shall look upon his like!

He is to be buried this day. The funeral will leave Hampton Court in time to be at the Royal Institution, Albemarle Street, at 2 o'clock p.m. Thence it will proceed to Highgate Cemetery. His funeral will be private, but let us hope that his country will not fail to erect a monument to his memory, worthy of his genius.

We have no Public Laboratory in this country, as they have in France, where really deserving students may carry out their researches at the public cost. What could be a more fitting monument to Faraday than such an institution, bearing his name?

ACADEMY OF SCIENCES.

AUG. 20, 1867.

(FROM OUR OWN CORRESPONDENT.)

Shooting Stars.—Animal Electricity.—The Pascal-Newton Forgeries.—Photographic Registration of the Beatings of the Heart.

The correspondence was without interest.

M. Coste presented, on the part of MM. Coulvier-Gravier and Chapelas, the result of their observations on the shooting stars during the nights of the 9th, 10th, and 11th of August of this year. They showed, by a tabular statement, that from the 5th of August, the mean hourly number at midnight on a clear sky, that is to say, corrected for the lunar light and the presence of clouds, was 16.2 stars; this became 33.7 on the 9th, 49.9 on the 10th, and 28.7 on the 11th; giving an average of 37.4. Comparing this with the year 1848, which had given for the mean hourly number, 110 meteors, it is plain that the quantity diminishes very sensibly.

M. Saigey, formerly collaborator of M. Coulvier-Gravier, has just published the results of his meteoric observations made in 1845 and 1849 for all the clear nights.

M. Schultzstein, of Berlin, read a paper on animal electricity, stating that all the phenomena are reduced to simple voltaic currents in which salt acts the part of the electromotor.

M. Chasles took up the discussion relative to Pascal's and Newton's letters. He is astonished that their authenticity has been doubted, inasmuch as they are exchanged between twelve different persons. The writings of Montesquieu is well-known; and there are letters from Mariotte, whose writing can be compared with that of manuscripts in the library, &c. There are about 500 letters and notes of Pascal, 200 of Newton, and 300 of Labruyère in the possession of Pascal.

M. Le Verrier declared his incompetence as member of the commission to inquire into the documents of M. Chasles, and regretted that he could not assist this gentleman in any way in the absence of proofs; and in polite terms demanded the usual proofs of authenticity required by astronomers, so that that they could judge when they received them.

M. Chasles replied in warm terms, and a rather stormy discussion ensued. He said that the number and nature of the documents communicated ought to satisfy all doubts relative to their authenticity! He added that he was going to publish the most curious letters,—for example, those of Molière to Rotrou, and Rotrou to Poquelin, poetry, unpublished, and other pieces by Rotrou, also letters, &c., from Corneille to Rotrou.

M. Chevreul stated to M. Le Verrier his acknowledgment of the inutility of a commission appointed with too much precipitation.

M. De Landolle proposed in the name of several foreign botanists a change in the nomenclature of botanical classification.

M. Ozonam presented a note on an apparatus by which the beatings of the heart are registered and photographed. They are made to act on the surface of a bent tube containing mercury, the fluctuations of which are noted in the same manner as those of the thermometer and barometer are photographed. He exhibited several curves obtained by this means, and some magnified by the megascope.

CORRESPONDENCE.

TECHNICAL EDUCATION.

To the Editor of the Chemical News.

SIR,—Having just returned from a fortnight's study of the Paris Exhibition, I read the paper on "Technical Education" in your last number with very great interest, and it induces me to offer a few suggestions, more especially in connection with the scientific training of the artisan class.

The advantages of such a training to those who are engaged in the mechanical and manufacturing industry of the country are so generally admitted, that it would be unwise, not to say positively injurious, to make any distinction in this respect between the employer and the workman. The latter, from the very nature of things, is often more likely to suggest improvements in processes which the former would overlook. Hence the value of a scientific training for the one is, at any rate, quite as important as it is for the other.

Assuming that our alleged inferiority in the present Exhibition is owing to the want of technical education, one is naturally led to inquire into the operations of the Science and Art Department—a branch of the Government recently created for the special purpose of promoting the scientific education of the people.

As far as my own experience goes, I am of opinion that the action of the department is far too limited to render any great service to the country. It serves to ascertain, by means of training and examination, that there is a very considerable amount of latent talent in the country, but takes no further steps to turn this talent to account. So far as the adult artisan is concerned, I know not that any more can be done than to put him in the way of applying the scientific knowledge he has gained to the more intelligent performance of his work. But with regard to the sons of artisans, who pass through this preliminary course with credit, and who give evidence of superior talents, is it right, or even expedient, to allow these talents to fall into decay for want of a higher culture?

Now, if we had possessed in England such schools as the *Ecole Centrale* in Paris, or the *Ecoles des Arts et Métiers* of Châlons, and other places, where youths of all classes are admitted to compete for admission, and, in cases where their parents or relatives are too poor, are provided for, either partly or wholly at the country's expense; I will venture to say that, far from occupying a position of inferiority to other nations in manufacturing industry, we should, with such advantages, have maintained a decided supremacy.—I am, Sir, &c.,

A TEACHER OF SCIENCE.

MISCELLANEOUS.

A Patent for Seeing Ghosts.—The "vital-force" patent on which we commented some little time since, has been out-done by a scheme which has just come across the Atlantic. According to Dr. Van der Weyde, in the *American Journal of Mining*, a spiritualist of New York has lately applied for a patent for an arrangement to make ghosts or spirits visible. It consisted in a room from which light and air was almost excluded, only air was admitted by a stop-cock, which was opened from time to time, and light was passed, in a very small quantity, through a piece of dark-blue or black glass, or fluid, so that when first entering the room nothing was seen, but remaining in it for any length of time a very faint view of the interior was obtained. The inventor asserting that the bodies of ghosts or spirits are so attenuated that common light passes straight through them and makes them invisible.

Carbonic Disulphide, Hydrate of.—E. Duclaux. When carbonic disulphide is rapidly volatilised, a white crystalline mass is formed which is a hydrate of carbonic disulphide. The crystals are very unstable, they decompose at -30° ; their composition is $2\text{CS}_2 + \text{H}_2\text{O}$.—(*Comptes R.* lxiv. 1099.)

Pascal and Newton.—The impudent attempt on the part of some French academicians to deprive Newton of the glory of the Law of Gravitation has now been effectually exposed. It will be remembered that when our Paris correspondent alluded to them a fortnight ago, we characterised Pascal's letters as forgeries. It will be seen from the following statement that Newton's letters are also forged. Sir David Brewster writes as follows to the *Athenæum*:—"As the biographer of Sir Isaac Newton, and the only living person who has examined his letters and MSS. in the possession of the Earl of Portsmouth, I feel that I am called upon to expose the forged correspondence between him and Pascal which has recently been presented to the French Academy of Sciences, and published in successive numbers of the *Comptes Rendus*, &c. After perusing this correspondence, I communicated to M. Chevreul, the President of the Academy, the most satisfactory evidence that the letters are forgeries; but as my letter may not be published till the Committee of the Academy give in their report, I am anxious that the truth, in so far as I can state it, should be known in this country. If the correspondence in question is genuine, Pascal has anticipated Newton in the discovery of the Law of Gravity; and our French foe across the Channel might justly charge Mr. Conduitt, Bishop Horsley, and myself—who, I believe, are the only persons who had thoroughly examined the papers of Sir Isaac Newton—with having destroyed the letters of Pascal, in order to give to Newton the honour, and to England the glory, of so great a discovery. 1. In the Portsmouth papers there is not a single letter from Pascal to Newton, nor any letter or document in which his name is mentioned. 2. Pascal is alleged to have heard of Newton's precocious genius as a mathematician, and to have written to him encouraging letters, when he was only eleven years of age! Newton was not a precocious genius. His great powers were very slowly developed. Till he was sixteen he was occupied with water- and wind-mills and dials; and, as he himself told Mr. Conduitt, his first experiment was made in 1658, when he was sixteen—an experiment, too, indicating very little genius. 3. Newton's mother, under the name of Anne Ayscough, thanks Pascal for his attention to her son; but Anne Ayscough ceased to have that name when Newton was only four years old, and had she written after that time it could only have been as Hannah Smith. 4. The letters of Newton are signed *I. Newton* and *Isaac Newton*. Newton's letters of correspondence were always signed *Is. Newton*; the only exception I know being when he signed *Isaac Newton* to a long scientific communication to Boyle. 5. According to the alleged correspondence, Newton received at least two hundred manuscripts and notes from Pascal, which he offered to return; but it does not appear that the offer was accepted. 6. Newton never wrote in French; his letters to Varignon and other French savants were always written in Latin. 7. The letters contain internal evidence that they were not written by Newton. He never could have expressed an eternal gratitude for the kindness of his friend. 8. An examination of the handwriting and of the paper by an English expert will, doubtless, add to the evidence given above, that the correspondence in question is not genuine."

Nitroglycerine.—The destruction of the *European* at Colon by an explosion of nitroglycerine, has been the cause of an action at law. The plaintiffs—the West India and Pacific Steamship Company—were the owners of the vessel; the defendants—Guion and another—merchants and forwarding agents. The defendants had received from their correspondents in Hamburg, Messrs. Bandemann, 70 cases of oil, described in the letter of advice as "glonoin oil," and one of 20,000 percussion caps to be forwarded to San Francisco. It appeared that the defendants knew very little concerning the oil they were shipping. Professor Abel, F.R.S., Professor Roscoe, F.R.S.; Colonel Boxer, F.R.S., Superintendent of the

Woolwich laboratory, gave evidence as to the nature of the material. By their evidence it was shown to be a highly explosive substance, the explosion being excessively rapid and unaccompanied by smoke, and it is produced by heat. Professor Abel stated that the greater the quantity of oil the lower would be the degree of temperature necessary to explode it, and having in experiments exploded 12 to 20 drops by keeping them for six hours daily at a temperature of 180°, he had arrived at the conclusion that a temperature of 110° to 130° would explode the quantity contained in one of the cases. It appeared that the commercial article, being far from pure, contained a certain quantity of free acid, which generated a gas and produced decomposition, which increased the heat, and the decomposition again was increased with the temperature, and all this tended towards explosion. Moreover, when the compound became saturated with this gas it became increased in bulk, and its pressure against the sides of the case became stronger, rendering it more liable to be exploded by concussion. To the oil and to the operation of these qualities in it they did not hesitate to assign the explosion, and Professor Roscoe stated that one case of this oil exploded would have destroyed the *European*. Colonel Boxer proved that it was practically impossible to explode a great quantity of percussion caps at once, for, although the explosion of one extended to the few immediately surrounding it, it never went further, and he produced a box of caps upon which he had let a hundredweight fall from a height of 6ft., and it appeared crushed and out of shape, but the caps were unexploded. Moreover, he had put two ounces of gunpowder into the centre of 2,000 caps in a cylinder and placed the whole in a packing-case and exploded, the powder. One-third of the caps only were exploded and the others were untouched. The mode of clearing the composition out of caps, when it is necessary to do so, is by shovelling 20,000 at a time into a heated oven; there is no explosion, and a minute at least elapses before the composition is consumed. The result of all this is that caps will not explode in a body and are not practically dangerous, and in consequence, the practice is to issue all caps from Woolwich, packed in the middle of the package of small ammunition; and no case of accidental explosion has ever occurred. For the defence, it was contended that the explosion might have been caused by torpedoes to be used by Chili against Spain, loaded amongst the cargo without the owners' knowledge. The jury found the oil to be the cause of the explosion.

Gun-Cotton Explosion.—Messrs. Prentice and Co. write to explain that the temperature of 170 would have been more correctly written 170°C. (or Centigrade) which is equivalent to about 340°F. (or Fahrenheit), the more usual English scale. This has long been considered the ordinary explosive point of gun-cotton. Since the introduction of the present improved system of washing the material after it has been reduced to a state of pulp, they have not an instance in their experience, extending over several months, where the explosive point has been found to be under 350° Fahrenheit. Without expressing any gratification on such an occasion, they cannot help feeling some satisfaction that such a quantity of gun-cotton, when not closely confined could be exploded without even the fracture of a pane of glass in any of the buildings only ten yards distant, forming on a grand scale an illustration that it is only when subject to a considerable degree of resistance or confinement that the destructive nature of gun-cotton is fully developed. The sporting cartridges made of "safety gun-cotton paper" (of which there were none in this part of the works) may be safely stored in any closet or cupboard, the particular mode of preparation rendering them still less liable to ignition, and harmless unless confined, as in the barrel of a gun.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Bulletin de l'Académie de Belgique. March 2, 1867.

A. KEKULE, "Reports on E. Dubois' Memoir on Monochlorinated Phenic Acid." VAN BENEDE, "Report on F. Terby's Memoir on the Method pursued by Spiders for connecting Distant Points by a Thread." A. QUETELET, "On the Determination of the Hour at which Falls of Aerolites generally take place." A. KEKULE, "On some Sulphuretted Derivatives of Phenol." "On the Sulphophenic Acids." E. DUBOIS, "On Monochlorinated Phenic Acid." F. TERBY, "On the Method pursued by Spiders for connecting Distant Points by a Thread."

April 6.

Sitzungsberichte der königlich-bayerischen Akademie der Wissenschaften. (Mathematisch-physikalische Classe.) March 10.

"List of Subjects for Prize Essays for the Year 1868."

SCHONBEIN, "Contributions to the Knowledge of Bin oxide of Hydrogen." VON KOELL, "On Peñolite and Osmelite." A. VOGEL, junr., "On the Variations in the Composition of Water at Different Depths." "On the Estimation of Ammonia." BAUERNEFELD, "On Atmospheric Refraction." "Experiments on Capillary Action at a Low Atmospheric Pressure."

April 21—May 5.

NAGEL, "Experiments on Capillary Action at a low Atmospheric Pressure." "On the Theory of Capillarity."

June 2.

A. VOGEL, junr., "On the Manufacture of Peat Charcoal." SCHONBEIN, "On the Formation of Bin oxide of Hydrogen during the Slow Oxidation of Organic Substances."

July 14.

A. VOGEL, junr., "On the Estimation of the Chemical Action of Light by its Influence on Prussian Blue." "On the Volatile Acids contained in Peat, and on the Variation in Quality of Peat from Different Portions of the same Bed."

November 10.

VON PETTENKOFER AND VOIT, "On the Quantity of Carbonic Acid exhaled and Oxygen consumed by the Human Subject during Waking and Sleeping, in Health and Disease." A. VOGEL, junr., "On the Assimilation of Silica by Plants." VON GORUP-BESANEZ, "Researches on Creosote." RECHNAGEL, "On the Expansion of Alcohol by Heat."

December 15.

STEINHEIL, "On a Portable Photographic Apparatus." E. VOIT, "Researches on the Laws of Diffusion of Liquids." SCHONBEIN, "On the Accelerative Action of Fluid Hydrocarbons and other Substances rich in Carburetted Hydrogen on the Oxidation of Absolute Alcohol, and on the Formation of Peroxide of Hydrogen which accompanies such Oxidation."

Sitzungsberichte der Wiener Akademie (Mathematisch-naturwissenschaftliche Classe.) October—November, 1866.

A. SCHRAUF, "On the Optical Properties of Crystals and of Allotropic Modifications." "On the Relations between Refractive Equivalents and Specific Volumes." T. PECKOLT, "On the Chemical Composition, Preparation, and Exportation of Guarana or Uarana." L. DITSCHNEIR, "On the Theory of Diffraction in Double Refracting Media." T. HEIN, "Analysis of a Meteorite from Dacca, Bengal." R. L. MALY, "On some Derivatives of Thiosinamine." H. HLASIWETZ and A. GRABOWSKI, "On Carminic Acid." G. MALIN, "On a Derivative of Rufigallic Acid." F. ROCHLEDER, "On the Tannin of the Horse Chesnut." L. BARTH, "On Paraoxybenzoic Acid." J. LOSCHMIDT, "On the Theory of Gases."

January, 1867.

H. HLASIWETZ, "On some Tannic Acids." "On the Constituents of Tea." "On the Basicity of Gallic Acid." L. BARTH, "On Protocatechuic Acid." "On the Brominated Derivatives of Gallic Acid, Pyrogallallic Acid, and Oxyphehic Acid." E. SCHWARZ, "Analysis of the Mineral Waters of Modling, near Vienna." M. VINGTSCHAU, "On the Action of Physostigmine on the Amphibia." A. SIERSCH, "On the Action of Common Salt on Zinc and Oxide of Zinc." A. BRIO, "On the Optical Properties of Crystals of Hyposulphite of Baryta." A. LIELEGG, "On the Spectrum of the Flame from Bessemer Converters."

Kunst und Gewerbeblatt. April, 1867.

SCHAFHAULT, "On the Cause of the Brittleness of Brass Wire when used for Lightning Conductors." "On the History and Progress of Tanning in Germany." E. DIETRICH, "On Fusel Oil and its Applications." K. SCHLEE, "On the Production of Artificial Meerschaum and Horn from Potatoes, Turnips, and Wood." "On Plastic Wood." "On the Composition and Utilization of the Wash Waters of the Wheat Starch Manufacture." "On Iron Minium as a Paint for Wood and Metal." "Price List of Philosophical Apparatus manufactured by P. Carl, at Munich."

May.

W. VENULETH, "A Press for forming Spent Tan into Cakes for Use as Fuel." E. LANGEN, "On an Arrangement of Apparatus for mechanically emptying the Cooling Cylinders of Retorts for revivifying Animal Charcoal." E. ZIEGLER, "On the Presence of Carbonate of Lime in Brick Clay, on its Influence on the Ware, and on the Methods of preventing its injurious Action." R. LINNER, "On the Use of moveable Tubs as Receptacles for Excrementitious Matters at Gratz."

NOTES AND QUERIES.

Carriage Grease.—Sir,—Can any of your readers kindly supply me with the composition of carriage grease, dry and wet wheel grease.—"GREASE."

Pyrologenous Acid.—Sir,—Will any of your readers inform me of a good method of converting crude pyrologenous acid into pure acetic acid.—W. A. (Mass.).

A New Gas.—Sir,—In the *Transactions* of the Aeronautical Society of Great Britain, page 49, Mr. F. Brearey, speaking of some desiderata in aerial locomotion, said that "if it were possible to discover a non-inflammable gas, the object would be attainable without danger." He mentioned this not without hope, as he had received a letter from a gentleman stating that he had succeeded in manufacturing such a gas, which, although at present expensive, he thought might be considerably reduced in cost, and that it was nearly of the specific gravity of hydrogen." Can any of your readers tell me what gas this can be? I am utterly at a loss to imagine.—SECFIC.

Naphtha.—Sir,—On referring to the 1st chapter of the second book of Maccabees, verses 19 to 36, the origin of the word naphtha will, I submit, be plainly seen. In a letter of the Jews from Jerusalem to those of Egypt, they state that when their fathers were led into Persia, the priests "took the fire of the altar privately, and hid it in a hollow place of a pit without water, where they kept it sure, so that the place was unknown to all men." After many years Neemias sent on the matter, when it was told "they found no fire but thick water." This thick water was then drawn up and laid on the sacrifice, and when the time came "that the sun shone, there was a great fire kindled." "When the sacrifice was consumed Neemias commanded the water that was left to be poured on the great stones; when this was done there was kindled a flame." "So when the matter was known it was told the King of Persia that in the place where the priests that were led away had hid the fire there appeared water, and that Neemias had purified the sacrifices therewith; then the King enclosing the place made it holy, after he had tried the matter," and Neemias called this thing naphtha, which is as much as to say, a cleansing.—W.C.

TO CORRESPONDENTS.

Hugo H.—Pure glycerine is not affected by boiling with nitrate of silver solution; common glycerine frequently contains compounds which possess a rancid odour, and which reduce nitrate of silver.

Puzzled.—Alumina prevents the precipitation of the ammonio-magnesian phosphate under some circumstances. This was pointed out by Herr Knop in our last volume, page 207.

J. Bigné.—Ascertain if the phosphoric acid contains phosphorous acid by adding to a solution of it an aqueous solution of sulphurous acid, and gently heating. If phosphorous acid be present, sulphur will be precipitated; if arsenic be also present, a yellow precipitate of sulphide of arsenic will be formed.

Tyro asks if we can oblige him with the name of a poison which will kill in about three days' time, and with all the symptoms of some known disease. The poison, moreover, must be one which an analytical chemist could not detect. Will our correspondent kindly forward his name and address?

Beak.—The explanation would prove too lengthy for this column. You had better refer to Wurtz's "Introduction to Chemical Philosophy," where the question is fully treated.

A Tyro.—The free library of the Patent Office, Southampton Buildings, Chancery Lane, will be most suitable.

Percolator.—It is the ammonia which chiefly acts. The sulphur combines with hydrogen, and is evolved.

A. Payne.—They are given in full in the *Journal of Gas Lighting*.

R. C. C. L.—The alterations are not important enough to be worth calling attention to.

G. J. de Winton.—The Mille Gazo-lamp is to be obtained of MM. Leplay, Noel & Co., Paris.

Specific Gravity Problem.—Several correspondents are thanked for their communications on this subject. "C. H. P.," and another correspondent, who gives no signature, have each given the right solution, taking Sidero's corrected figures, viz. sp. gr. = 7.587. "H. Catheldron" uses the original data, and brings out the sp. gr. = 15.4104. "Y. O. U." "O. Jennings," "John Fordyce," and "J. B. T." give erroneous formulæ. "Hugo Schmidt," "Ed. Moyes," "J. Hazlewood," "W. H. H.," and "E. Robinson," send elaborate criticisms on all the published formulæ, and each give correct results, with general methods for solving all such problems. To print these letters would occupy several pages, and as they only give in different language the general formulæ already published, we think little good would be gained by prolonging the discussion.

Communications have been received from D. Forbes, F.R.S.; W. Ainsworth (with enclosure); J. Spiller; C. R. C. Wright, B.Sc.; R. C. C. Lippincott; Dr. Parkes, F.R.S.; G. J. de Winton; W. Huggins, F.R.S.; A. Payne; S. Reeve; A. Pritchard (with parcel); H. Woodward; Dr. Adriani; E. Anderson; P. Jestrám; J. Foreman; G. Griffith; F. Price (with enclosure); Dr. S. Smith; Edward Burn; Edward Beanes; W. Armstrong; J. Cubitt; (with enclosure); Howards and Sons; S. Rew; Prof. Pepper (with enclosure); Page & Tibbs (with enclosure); R. Alison; J. J. Buchanan; C. Tennant (with enclosure); H. Catheldron; O. Jennings; J. Fordyce; Hugo Schmidt; E. Moyes; J. Hazlewood; E. Robinson. W. A. Townsend (with enclosure).

SUPPLEMENT TO THE CHEMICAL NEWS.

VOL. XVI., No. 404.

PHILOSOPHICAL CONCEPTIONS OF CHEMICAL PHENOMENA.

THE "fundamental definition" of a chemical phenomenon lately advanced by Sir Benjamin Brodie, to the effect that "A chemical phenomenon is an operation on the unit of space, the result of which is a weight," has strongly directed the attention of chemists to the primary conceptions on which the philosophy of their science is based.

At such a juncture it cannot but be interesting to set in contrast with the above startling philosophical innovation, one of the most clear and powerful expositions extant of the received mode of viewing this abstruse question.

Such an exposition we find in the ninth chapter of the admirable "Introduction to Modern Chemistry" lately put forth by Professor Hofmann in collaboration with Mr. F. O. Ward,—"whose well-known powers of lucid composition, and habits of philosophical thought, are traceable," as his illustrious colleague justly observed in his preface, "in every chapter of the work."

We shall the more readily lay these extracts before our readers, because, while specially apposite to the present tenour of chemical meditation, their appearance will redeem the promise made by us, in our first review of this book, to give it a second notice in our columns.

We therefore, without further preface or apology, proceed to lay the following extracts before our readers, merely remarking that we have here and there exercised our editorial privilege of excision and abridgment.

"Thus far," say the collaborating authors, "we have not quitted the domain of experience, of observation; to the causes of the remarkable phenomenon we have contemplated, our attention has not yet been turned. Yet the inquiry into the causes of observed phenomena is urged on us by one of the strongest instincts of our intellectual nature. That instinctive curiosity cannot, indeed, be fully satisfied. The first causes of phenomena lie beyond the limited scope of our perceptive and reasoning faculties. The conditions of their existence or production, and their relations of succession and similitude are, indeed, open to investigation; but their intimate nature and prime origin are for us inscrutable mysteries. We may, however, by the aid of imagination, form *hypotheses*, to connect the results of our experiments, and to guide the course of our inquiries. And, though merely speculative hypotheses, discovered from experimental investigation, are to be deprecated as vain and sterile exercises of ingenuity, hypotheses based upon facts, assisting in their conception, and deriving probability from the number thereof which they connect and explain, besides (and above all) tending to suggest new experiments, deserve to rank among the most valuable aids to scientific research.

"Hypotheses are, of course, to be held provisionally, subject to modification and abandonment, in so far as they may from time to time prove inconsistent with the results of further experimental research. On the other hand, when hypotheses embrace and explain extensive ranges of phenomena, when experiment confirms the results they foreshadow, when successive discoveries raise them higher and higher in the scale of probability, they lose more and more their provisional character, and gradually assume the name and rank of *theories*, till at last they come to be embodied among the recognised doctrines of philosophy.

"The observed phenomena of combination in definite proportions by weight and volume, are susceptible of explanation by a theory in the highest degree probable and suggestive, which comes next in order for our consideration.

"In order to arrive at this theoretical conception, we must ask ourselves, what is matter? Of what parts is it composed? How are these constructed and held together? How comes the very same matter, water for example, to present itself sometimes in the solid form, as ice; sometimes in the liquid form, as the same ice when melted; sometimes in the gaseous form, as the same melted ice changed to dry steam by further heating? And, lastly, what happens to matter, what changes does it undergo, when its various elementary forms combine, as we have seen them, to produce bodies having properties wholly different from those of their constituents?

"Setting aside the more transcendental speculations of philosophers upon the nature of matter, let us here select for consideration those hypothetical conceptions of its structure which seem best adapted to connect and explain the results of modern research; and which by enabling us to comprehend the phenomena we have already witnessed, may also assist us in shaping the course of our further experimental researches.

"Let us, for this purpose, consider the familiar body, *water*, into the nature of which our experiments have already given us some insight; and let us consider it in its three conditions, as ice, as fluid water, and as water-gas or dry steam. What is the first thing that strikes us in looking at them?

"The first thing that strikes us is, that ice, water, and steam manifest two sorts of activity;—one exerted by masses of sensible magnitude, acting through measurable distances of space; the other operating between particles, and through intervals of space, so minute as to be incommensurable.

"The attraction of mass for mass of matter, as manifested in the courses of the celestial bodies, in the movement of falling bodies, and in the pressure of bodies at rest upon the ground, exemplifies the first kind of activity. This is equally observable in the ice, in the water, and in the water-gas; for these all possess *weight*; a sensible mass of either reciprocates attraction with the earth, through measurable distances of space.

"The Latin for mass is *moles*; and its modern diminutive, *molecula*, is employed to designate "a little mass," that is to say, a material particle of incommensurable minuteness; hence the reciprocal actions of minute particles through insensible intervals of space are distinguished as *molecular*. We may fairly therefore contradistinguish, by the epithet *molar*, the reciprocal actions of measurable masses through measurable intervals of space.

"The means of mechanical comminution at our disposal, our grinding-mills, mortars, and the like, do not carry us beyond the *molar* subdivision of matter. However finely we might grind up ice, for example, if we took care to keep the temperature below freezing-point, we should still have masses each consisting of several molecules. For, our finest ice-powder would still consist of very small fragments of solid ice; and if, of this ice-dust, we took the smallest grain, we could, by applying heat, turn it into water, thus proving it to have *parts*, capable of separation, so as to be rendered moveable amongst each other. There is no instance of liquefaction resulting from the mechanical comminution of a solid body. Hence we take it as certain that the most impalpable product of mechanical pulverization is still a cluster of molecules.

"We are thus enabled to distinguish in matter two kinds of divisibility, *molar* and *molecular*; the former being accomplished by *mechanical* means, and only resulting, even when pushed to its utmost attainable limits, in the production of a molecule-cluster or mass of sensible dimensions, which may be termed a *mole*; while the

latter is accomplished by *physical* means (that is to say, by the aid of physical forces, such as heat), resulting in the disruption of the masses or *moles* into their incommensurably minute constituents *molecules*.

"The study of the reciprocal action of material *masses*, or *moles*, constitutes the science of *mechanics*; a science of the deepest interest, abounding in simple and admirable laws, with which, however, we are not at present concerned.

"Turning to the consideration of *molecular* activities, of those which are distinguished by the incommensurable minuteness of the particles of matter, and of the intervals of space, between and through which they take place; and looking once more at the samples of matter before us—at our ice, our water, and our water-gas or steam; we are again, as before, struck with a contrast between two diametrically opposite kinds of activity, one conspicuously manifested in the solid ice, and called *molecular cohesion*, the other especially manifested in the water-gas, and termed *molecular repulsion*. The former force gives to solid bodies their tenacity; to the latter, gaseous bodies owe their extreme tenuity, and the free mobility of their molecules amongst each other."

"In fluid bodies, here represented by our water, we observe these two forms of molecular activity balanced at an intermediate point. The molecules of fluids cohere with considerable force; as we perceive, when a rod is dipped into water, and a bunch of them taken out, sticking to each other, and also to the rod, in the form of a pendent water-drop; but this cohesion is exceedingly feeble as compared with that of the same molecules agglomerated in the solid form in a block of ice. Again, the molecules of fluids are moveable amongst each other; as we notice when water is shaken in a vessel, agitated with a rod, or poured into another glass; but their mobility is far inferior to that of the molecules of gas. In vain should we dip our rod into the gas to take up a drop of it; we should obtain no coherent bunch of gas-molecules, like the pendulous water-drop. And it is precisely to their superior molecular cohesion that fluids owe their inferior molecular mobility as compared with gases.

"This difference of comportment is not surprising when we reflect how much greater are the intervals which separate the molecules of a gas—of our water-gas, for example—than those which intervene between the molecules of the same body in the form of ice or of water."

"What is the nature of the intervals between the molecules of a gas?—are they empty space, or are they filled? and, if so, how, or with what are they filled? That they are not empty spaces we have very good reason to believe, on account of the powerful resilient property manifested by gases when forcibly compressed.

"But what is the nature of this elasticity or resilience—to what power or force is it due?

"Several phenomena point to *heat* as its cause. Heat is the agent by which ice is made to pass, through the fluid, into the gaseous form; and, with every increment of heat, the elastic power of the ice-derived gas augments.

"To the questions, therefore, what is a gas? and with what are the intervals between its molecules filled? succeeds the question, what is heat? This brings us face to face with one of the most ardently-mooted and deeply-interesting philosophical questions of the day. For some, heat is a species of thin ether, vibrating in the manner of light; for others, it is a pure force, having neither parts nor weight; for a third class of thinkers, of late years the majority, heat has no separate existence, but is merely a mode of motion, the result of the vibration of material molecules.

"It is no part of our present task to attempt the solution of this deep and difficult problem. We may content ourselves here with the conception that heat, whatever may be its intimate nature, so operates, when it becomes latent in a gas, as to surround each molecule with a sort of repel-

lent atmosphere which tends to keep it apart from its fellows; and that these molecular force-spheres—or, to employ the Greek equivalent, *dynami-spheres*, more shortly, *dynaspheres*, when mechanically compressed, counteract the pressure with exactly equal energy, and on the removal of the pressure, restore the gas (other things being equal) to the exact volume it previously possessed.

"It thus stands clearly demonstrated that, if equal volumes of the elementary gas, hydrogen, and of the compound gas, hydrochloric acid, be taken under any given pressure, and the pressure be doubled for each, each becomes reduced to half its former volume, and at the same time acquires double its former resilient force, or elasticity; which it exerts in counterbalancing the pressure from without.

"It stands equally proved that, if equal volumes of hydrogen, and of hydrochloric acid gas, taken at equal degrees of pressure and temperature, be exposed to equal increments or decrements of heat, they undergo equal degrees of expansion and contraction.

"It has been experimentally established as a law, that all true gases, simple as well as compound, comport themselves in sensibly the same manner under like variations of temperature and pressure; whence the inference fairly follows that their molecular structure is the same. Assuming, then, each gaseous molecule to be clothed or enveloped by a resilient dynasphere (as we have termed it), due, in some unknown way, to the influence of latent heat; experiment justifies us in inferring, from the identical comportment of all gases, when exposed to like variations of temperature and pressure, that they all contain, in equal volumes, an equal number of molecules so clothed; and that, as an obvious corollary, the diameter of these gas-molecules (including in that term as well the dynaspheres as their material nuclei) is, under like physical conditions, precisely the same for all gases. To express it more shortly, our unit-volume, or litre, whether of hydrogen, of hydrochloric acid, or of any other gas, simple or compound, is composed of mutually repellent dynaspheric molecules, equal (*omnibus paribus*) as to their *number*, and (consequently) as to their *size*.

"At this point of the inquiry we may advantageously resume the consideration of material divisibility, of which we have already studied two forms or grades, the *molar* and the *molecular*; the former consisting in the mechanical disruption of large masses into small ones, the smallest still possessing sensible magnitude; while the latter is the further disruption, by physical agents, such as heat, of moles or masses, whether large or small, into their constituent molecules; that is to say, into parts distinguished from the minutest moles by the fact that they (the said parts) possess no commensurable magnitude at all. In the particular sample of matter which we have selected for study, as being the most familiar of all compounds, we see molecular succeeding to mere molar division, when heat melts comminuted ice into water, and then raises water into invisible steam or gas, by clothing its molecules with the mutually repellent dynaspheres, each dynasphere 1689 times larger than its material nucleus.

"Infinitesimal as this subdivision of matter appears,—inexpressibly minute as we cannot but conceive the material particles to be that form the central nuclei of the dynaspheres of bodies so attenuated and rare as the invisible gases,—we yet know, by experimental proof, that a further comminution of matter is possible; and that, as the smallest mass or mole of any compound may be broken up into its constituent molecules, immeasurably smaller still, so the ultimate molecule itself, however small we may choose to conceive it, is nevertheless still a *compound*, consisting of at least two parts, which, by chemical agency, may be detached from each other, so as to resolve the compound into its elements.

"Here the divisibility of matter, so far as our experimental knowledge extends, reaches its final term. The *elementary* bodies are, as we remember, so called pre-

cisely because they resist every agency, mechanical, physical, and chemical, which we can bring to bear in the hope of dividing or decomposing them. We may imagine the two elementary particles which form the compound molecule of hydrochloric acid, for example, to be as small as we please. In this respect we may give the imagination free rein; we may conceive the particle of hydrogen, or of chlorine, to be divided and subdivided as many millions of times as we like,—or rather, until the imaginative power is baffled by sheer exhaustion in the endeavour to push this conception further. No experiment yet made tends to restrict the freest range of our mental faculties in this direction; their only limitation lies in their own finite scope, doubtless more or less extensive in different minds. But, when we have, each of us, thus reached the idea of the smallest elementary particle which it is within the power of the mind to picture, all experience stands opposed to our going still further, and presuming to declare the elementary particles capable of division *ad infinitum*. Not one experimental result can be adduced in support of such an assertion. At this point, therefore, the experimental philosopher arrests his inquiry. Beyond this limit he sees only the dream-land of metaphysical speculation—a region essentially sterile because shut out from cultivation by means of experiment, from which alone can spring the harvest of Truth in the proper sense of the word; having for its foundation natural facts; for its object the study of their relations; for its result the determination of their laws.

"To the metaphysical speculators, therefore, let us cheerfully resign the utter futile and fruitless discussion whether even elementary matter may not be infinitely divisible. It is enough for us to know that, at all events, we cannot infinitely divide it, but that, relatively to our powers and purposes, to the limits of our imagination as well as of our experience, the assertion of the infinite divisibility of the elements is one we are not justified in making.

"We thus arrive at the conception of indivisible particles as the ultimate constituents of elementary bodies, and these particles have received the appropriate name of *atoms* (from the Greek word *τέμνω*, *I cut*, *I divide*, with the privative *a* prefixed in token of negation).

"The addition of this final term completes and enables us to epitomise our view of the threefold divisibility of matter, molar, molecular, and atomic; the first (molar) being performed by *mechanical* means, and resulting, when pushed to its utmost limits, in masses or moles (clusters of molecules) characterised by their possession of sensible magnitude; the second (molecular) accomplished by the agency of the physical forces (heat, electricity, &c.), employed under special conditions for the purpose, and resulting in the production of the dynaspheric *molecules* of which we reasonably conceive compound bodies to consist; the third (atomic) being capable of accomplishment only by agencies, such, and so applied, as to produce *chemical* decomposition, breaking up the incommensurable molecule itself into its elementary particles, which (as just explained) are called *atoms*, because incapable of further disruption or comminution by any means at our disposal.

"This conception of the threefold divisibility of matter, molar, molecular, and atomic, being once clearly understood, and firmly grasped by the mind, we may usefully proceed, in the light which this theory supplies, to compare as to their structure compound with elementary gases. At first view we should be disposed, perhaps, to anticipate as probable, that, while the compound gases would be formed of divisible molecules or atom-clusters, the elementary gases would present no such complexity of structure, but consist merely of separate and indivisible elementary particles. But a little consideration will show us that this view is incompatible with the results of our preceding inquiry.

"Let us, to simplify our calculations, assign to the unknown number *n* of HCl molecules, existing in our biliteral volume of hydrochloric acid gas, some definite numerical value, say 1000.

"This being assumed as the number of molecules in 2 litres, the number in 1 litre is of course just half, or 500; and, as we recognise that equal volumes of all gases contain equal numbers of molecules, the litre of hydrogen and the litre of chlorine, which go to the formation of our 2 litres of hydrochloric acid gas, must likewise contain 500 molecules each.

"Now, as each molecule of hydrochloric acid contains 1 atom of hydrogen joined to 1 atom of chlorine, the 1000 molecules of hydrochloric acid must, of necessity, contain 1000 atoms of hydrogen joined to 1000 atoms of chlorine—the whole number of atoms present being therefore 2000.

"But we have just seen that one litre of hydrogen and one litre of chlorine contain, not 1000 molecules each of the respective bodies, but only 500.

"It follows clearly that 500 molecules of hydrogen and 500 molecules of chlorine have supplied respectively twice as many atoms of those constituent bodies; each contributing its 1000 atoms to the aggregate number of 2000 atoms, existing in the 1000 HCl molecules, contained in our 2 litres of hydrochloric acid gas.

"If 500 molecules of an elementary gas supply 1000 atoms it is plain that each molecule supplies 2 atoms; and thus we clearly perceive that the molecule of the compound gas under review, and the molecules of each of its elementary constituents, are all formed on the same type—that type being the first of our quadruple series, viz., the hydrochloric acid or *diatomic* type.

"This is a remarkable and striking, yet strictly logical deduction. It completes a chain of reasonings which, if correct, justify the conception that simple as well as compound gases are complex as to their molecular structure; and that this structure, for all the permanent elementary gases, is of the diatomic type."

THE CHEMISTRY OF METEORITES.

By W. WARINGTON SMYTH, M.A., F.R.S.

M. Daubrée, already so distinguished for his researches on metamorphism, has recently published the results of his Synthetical Experiments on Meteorites, and has thus brought before us, from an entirely different point of view, an inquiry into the nature and origin of the silicated magnesian rocks and minerals.

M. Daubrée first describes his experiments on the *imitation of the meteoric irons*. The most characteristic feature of these masses is the crystalline pattern (Widmanstätten's figures) which is brought to view on a polished surface by the action of an acid. Simple fusion of the meteorite of Caille (Var) in a *brasque* of alumina (to avoid the contact of carbon, which would have combined with the iron), was insufficient to reproduce the appearance, although the resulting substance was certainly crystalline. Further experiments, in which soft iron was associated with some of the other substances that commonly accompany meteoric iron, such as nickel and protosulphide of iron and silicon, yielded a highly crystalline result, but not yet of the true character. If, however, to the soft iron was added phosphide of iron, in the proportion of from two to five or ten per cent, and, still better, if there was introduced at the same time nickel, and if a mass of as much as two kilogrammes in weight was operated on, there appeared, when the cooled lump was polished and etched, in the midst of dendritic patterns of great regularity, lines of a brilliant material dispersed in a reticulated form.

A third mode of attempting the imitation was that of melting down certain terrestrial rock-substances, as peridot, lherzolite*, hypersthene, basalts, and melaphyres. By this means specimens of iron were obtained which, both in composition and structure, bore strong

* Lherzolite (so called from Lherz, in the Pyrenees) is a rock composed of peridot, enstatite, and pyroxene (augite).

resemblance to many of the siderolites. Especially was this notable in the metal obtained from the Iherzolite of Prades (Eastern Pyrenees). These artificial irons were then found, like the natural meteoric ones, to contain nickel, chromium, and phosphide of iron, the latter in long needles recalling the appearance of the natural patterns.

Imitation of the Meteoric Stones.—Contrary to what might have been expected from the appearance of the black vitrified crust on the surface, the substance produced by the melting down of meteorites obtained from above thirty different falls, was in every case highly crystalline. Those of the common type present a group of metallic granules, disseminated in a stony mixture of peridot (Mg_2Si) and enstatite ($MgSi$), the former generally on the surface as a thin crystalline pellicle, the latter in the interior as long acicular crystals. A notable contrast was yielded by the aluminous meteorites, such as those of Juvinas, Jonzac, and Stannern, which produced, instead of crystalline, a vitreous mass.

But perhaps the more remarkable results were those obtained synthetically by melting down pieces of rock characterised by the minerals peridot and enstatite. For this purpose peridot (olivine), from the basalt of Langeac (Haute Loire), and Iherzolite, from Vicedossos and Prades, were fused in earthen crucibles. They melted easily and yielded crystalline substances, the latter especially closely resembling the original rock. The proportion of enstatite (the bisilicate of magnesia) was found to be increased by the addition of silica.

When similar mineral substances were melted in presence of a reducing agent, the iron (which in the other case remained combined in the silicate) segregated itself in grains of various sizes, separable by the magnet. Thus a perfect analogy was established between the above rocks and the meteorites, as well in their stony minerals as in the iron, which always contained nickel.

Furthermore, some remarkable characters in the structure of the stony meteorites were found to have been imitated, especially the delicate parallel lines attributable to cleavage, which are visible when a thin slice is examined under the microscope, and the globular structure where the little spherules are sometimes smooth at the surface, at others drusy, or roughened with the points of minute projecting crystals, like the meteorite of Sigena, November 17, 1773.

When hydrogen was employed as the reducing agent, the results were very similar, and the reaction would take place at a temperature not exceeding red heat.

Again, another method of imitation, the reverse of the foregoing, was by oxidation. From silicide of iron, heated in a *brasque* of magnesia by the gas blowpipe, a substance was obtained extremely similar to the common type of meteorite. The iron was separated partly as native iron, partly as a silicate, forming peridot, some of it in the crystallized state. Further details of resemblance were attained by heating a mixture of silica, magnesia, and nickelliferous iron, phosphide and sulphide of iron. The stony gangue of the melted product was found to be free from the latter three substances; and instead of the simple phosphide introduced in the experiment, there was observable the triple phosphide of iron, nickel, and magnesium, first noticed by Berzelius in meteoric irons.

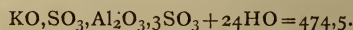
The preceding experiments suggest some important deductions on the condition of the planetary matter from which the meteorites have been diverted to our own globe. M. Daubr  e makes no attempt to enter the lists with Von Haidinger†, Baron Reichenbach, Prof. Lawrence Smith, and others, on the questions attending the entry of these bodies into our atmosphere, and the circumstances of their fall; but, considering that their surface alone is modified by these conditions, he infers that their interior mass remains the same as when

it was wandering in space, and may to a great extent be taken as a sample of the material of the planetary bodies of which they are the fragments.

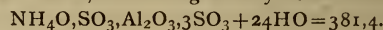
Seeing how nearly the composition and structure of the meteorites are reproduced by the two methods of experiment, M. Daubr  e refers by their aid to the original mode of formation of the bodies from which these meteorites come.

If they were produced from silicated minerals by reduction, in which carbon was the reducing agent, it may be objected that the iron could scarcely have remained in the metallic state; and if hydrogen be supposed to have been the reducing agent, water ought to have been formed at the surface, whence it appears more simple and reasonable to recur to the idea of an oxidizing process. Allow that silicon and the metals existed at one time in the meteorites, not combined with oxygen as they now mostly are, and this by reason either of too high a temperature to allow them to remain in combination, or of too great a separation of their particles, then, as soon as, by their cooling down or by their condensation, the oxygen was able to act upon the other elements, it would at once combine freely with those for which it had most affinity, and if not sufficient in quantity to oxidize the whole, or not enabled to act long enough, would leave a metallic residue. In fact there would be produced the silicate of magnesia and iron, peridot or olivine, and granular portions of nickelliferous iron and of sulphides and phosphides of iron. These views, whilst applicable to a large proportion of the meteoric bodies, would require modifications for those rarer varieties which consist essentially of pyroxene and anorthite. Whilst the magnesian silicates crystallise so readily after simple fusion, these latter substances would only melt to vitreous and amorphous masses, and in order to become crystalline would have needed the presence of water.—*Address to the Geological Society. Anniversary meeting, 1867.*

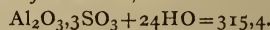
Sulphate of Alumina.—Potash alum is composed of



Ammoniacal alum, the most generally used in Paris,



Simple Sulphate of Alumina,



Every 100 kilogr. of these three products contains the following proportion of sesquioxide of aluminium.

For 100 kilo.	potash alum	..	10.820	kilo. of Al_2O_3
"	"	Ammoniacal ditto.	..	13.460 " "
"	"	Sulphate Alumina	..	16.270 " "

Thus, it is easy to find the real value of the simple sulphate alumina, the more so as that which constitutes the real value of alum, is not the potash or the ammonia, but only the alumina. It is the alumina that the dyer wants to fix his colours in a state of lacker; the tanner wants the alumina to preserve his hides, and make them fit for gloves and shoes; again, the paper-maker requires the alumina to make his pulp fit for writing on, that is to say, that paper which contains a resinate of alumina obtained from the double decomposition of sulphate alumina with a solution of resin in caustic soda,—this paper, we say, can take writing without fear of the ink running. If the alumina in these salts is the only part useful in commerce, one ought to look for a product which to a given weight shall contain the largest quantity of this alumina. Preference should be given to sulphate alumina, which contains 16 per cent useful product, whilst potash alum only contains 10.1 per cent.—*Moniteur Scientifique*, vol. ix., p. 574.

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† See Haidinger, *Phil. Mag.* November and December, 1861.

THE CHEMICAL NEWS.

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

DUNDEE MEETING, 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

DUNDEE, Sept. 5, 1867.

IN spite of the great distance from London, and the depressing influence exerted by the parsimony of the railway companies, the present meeting promises to rival any of the previous northern gatherings, excepting, perhaps, the Newcastle meeting in 1863, at which the total number of attendants amounted to 3,335. At the time I write they are nearly equal to the total of the Nottingham meeting—2,300, and new arrivals are coming, both by rail and boat. The exigencies of the Post Office allow me only a very limited time to furnish this preliminary letter, so that if my narrative is imperfect in any material sense, I will communicate by telegraph, and the facts may then be interpolated by you. The lodging accommodation in the town seems as yet in excess of the demand, and the prices first quoted are being reduced. Probably this may be accounted for by the fact that a large proportion of the tickets issued has been purchased by residents in Dundee and the neighbourhood. The General Committee met yesterday, at the Panmure Street Chapel, at 1 p.m.

Professor HIRST, one of the General Secretaries, read the report of the Council for the year 1866-7.

Mr. W. SPOTTISWOODE then read the report by the treasurer, which was also agreed to.

Mr. GRIFFITH, Assistant General Secretary, read the report by the Parliamentary Committee.

REPORT OF THE KEW COMMITTEE.

Mr. J. P. GASSIOT read the report of the Kew Committee.

The ASSISTANT GENERAL SECRETARY then read the report of the committee appointed by the Council of the Association to consider the best means for promoting scientific education in schools. The report, after pointing out that there is already a general recognition of science as an element in liberal education, and stating that general education in schools ought to include some training in science, went on to refer to the difficulties in the way of introducing science into schools, which the committee, however, considered easily surmountable. With a view to the furtherance of the scheme, the committee made the following suggestions:—

1. That in all schools natural science be one of the subjects to be taught, and that in every public school at least one natural science master be appointed for that purpose.

2. That at least three hours a week be devoted to such scientific instruction.

3. That natural science should be placed on an equal footing with mathematics and modern languages in effecting promotions, and in winning honours and prizes.

4. That some knowledge of arithmetic should be required for admission into all public schools.

5. That the universities and colleges be invited to assist in the introduction of scientific education by making natural science a subject of examination, either at matriculation, or at an early period of a university career.

6. That the importance of appointing lecturers in science, and offering entrance scholarships, exhibitions, and fellowships for the encouragement of scientific attainments, be represented to the authorities of the colleges.

In the afternoon the grand floral fête in Baxter Park was opened under very favourable circumstances as to weather; this is considered to be the largest and finest floral and horticultural show ever held north of the Tay. It was again open this morning to private inspection of the members of the Association.

Yesterday evening the first great meeting took place in the Kinnaird Hall, the company being but little assisted on their way to the assembly by the electric light, which was exhibited in front of the High School, under the charge of Mr. Louis Schwendler. At eight o'clock Sir Roderick I. Murchison, F.R.S., acting for Mr. Grove, who was prevented by illness from attending, in a short speech formally vacated the chair to his Grace the Duke of Buccleuch, the President of this year.

The large meeting-hall was crowded in every part, and confusion had been as much as possible avoided by numbering each seat, and not admitting members or associates unless they had previously got their tickets stamped with a similar number. Your correspondent, who was not aware of this judicious regulation till the last moment, would have had a poor chance of hearing the forcible speech of the noble president, were it not that a General Committee ticket carried with it the privilege of admission to the platform.

Sir RODERICK MURCHISON, in introducing the Duke of Buccleuch, expressed regret at the unavoidable absence of Mr. Grove, in whose behalf it had fallen to him as a former President, and as one who had filled nearly every office in the Association, to hand over the chair to the President elect.

About a quarter to eight o'clock, considerable excitement was caused by Sir David Brewster having been seen to become suddenly faint. He was conversing with Professor Balfour, who sat behind him, his arm being thrown over the back of the chair, when he ceased speaking, his face became deadly pale, his hand fell from the back of the seat, and he was about to fall, when Professor Balfour sprang forward and caught him. After Sir David Brewster had been extended motionless on the platform, and water brought, in a few minutes he recovered from his swoon, and was carried out of the hall.

After the confusion had subsided, Professor PHILLIPS came forward and said: Our highly honoured member, Sir David Brewster, has been affected by the heat of the hall. He is now decidedly better.

The Duke of BUCCLEUCH, having taken the chair, said—Gentlemen of the British Association for the Advancement of Science, and ladies and gentlemen,—As to what has fallen from Sir Roderick Murchison, I feel that, whatever bold deeds my ancestors may have done, or may have attempted, perhaps in one sense I have attempted the boldest of them all. If it were only a question of physical endurance, or dashing enterprise, I should not have felt abashed, nor shy, nor disinclined for the encounter. I think the old spirit of the Borderer would have carried me through. I have been told, and perhaps with reason, that it is better and more usual upon such a great occasion as this for the President to prepare his speech or address with care beforehand, to commit it to writing, and give an opportunity of having it put in print for the convenience of the members of the Association, and also of those whose particular vocation and duty it is to communicate to the public that which passes at public meetings. Unfortunately, perhaps, for

myself, and still more unfortunately for you, I have not so done. I never in my life attempted to pen an address or to prepare a written speech to be delivered. If I had done so, and had recourse to the productions of the pens and heads of others, I might have read an address to you in flowing language—full of science, full of information; but I could not have pretended that what I read came from myself. I preferred rather to fail by speaking what I had to say direct from myself, as it came from my heart and from my head, than have recourse to the assistance—although most valuable it would have been—of the thoughts and pens of others.

When I consider the nature and intention of this great Association, I cannot but feel that one of the greatest gifts which Providence has bestowed upon man is great intellectual power. It is a talent of the highest price; it is a talent vouchsafed to but few. Happy are those men themselves, and blessed is it for this country and for the world, when they who have the intellectual power have also the will to exercise it, the power to exercise it, and to direct it aright. You will rarely see that any one man possesses the full intellectual power to make himself master of the whole. Ladies and gentlemen, this reminds me that since the last meeting of this Association, and within a very short time, one most distinguished member of it has been gathered to his fathers—I mean Professor Faraday—one of the most distinguished men in his own branch of science, one who having great intellectual power, and having great personal will, was determined to rise above that position in life in which he happened to be born. Happily for him he took a line, and sought a friend in one who was able to forward his views; and I believe that in his own department of science no man was more prominent than Professor Faraday lived to become. In him we have to mourn one that is lost; but when we mourn one that is lost, is it not an incentive to many others who may have been born in the same position as himself, or may, perhaps, have been born in other positions, in a higher and better position than he, with every opportunity of cultivating science, and instructing themselves in every way? Is it not an incentive to every man who may feel himself possessed of that power to push himself forward quietly, unostentatiously, but at the same time, not for the personal pride of position, but for the more generous ambition of being a great benefactor to his country. We heard to-day at the preliminary meeting, a report made upon an important matter—namely, that of having science taught at our public schools—that it should form a portion of the curriculum of study in every school. I quite agree with that, but I think you must not, at all events in the first instance, attempt to push it too far. Give the youth a taste for science, and when they have acquired this taste, those who have an aptitude for the sciences will each be very much inclined to follow a particular science for himself. You can no more drive science down a boy's throat than you can teach mathematics to a horse. (Laughter.) If he has a turn for it, he will take it in; if he has not a turn for it, he will say that it is a greater bore than Latin or Greek; but to teach him the elements of science is of great importance. In every relation of life a knowledge of science is becoming more and more necessary. I need not go further than the town in which we are at present assembled. Where would the prosperity of this town have been had it not been for science. You will say we have manufactures of flax, hemp, jute, and things of that sort; there is not much science in that. Well, go to the cultivation of these plants—go on to the preparation of these plants after they are cultivated, and bring them to this country. Do we not require some amount of science to build those ships, and to navigate them? and when those vessels come to port do we not require some science to produce the docks and harbours in which these vessels lie? Then again, when you come to the manufacture of the raw material, do we not require some science in chemistry and in mechanics; and in mechanics, we require mathe-

matics to begin with? Then, these inevitable faculties are necessary to produce the machinery by which all these raw materials are to be made into useful articles of commerce. Is it not also the case when we come to the cultivation of the soil? What do people do now? It is not the rule of thumb process—the old story, that you must put lime here, and farm manure there. You ask, why? The answer is, it stands to reason—because the soil requires that. Standing to reason is a very good answer; but the man who gives it goes by the rule of thumb. We want a man with science and chemistry to tell us why we do these things—why we apply one description of manure to one soil, and one to another; and why, if we apply this description of manure to one place and to another, we apply it to the wrong place. Again, we have many other branches. Take Geology for instance. I am sure it would be difficult to say how many hundreds of thousands have been sunk and lost in seeking for that wonderful vein of gold in the shape of coal, and other things, which nobody would have dreamt of doing if a question had been asked of any common, ordinary geologist. I was talking a little while ago of scientific education in schools. We want scientific education in our Universities. We want to have natural and physical science taught in our Universities. It is not many months ago since a powerful effort was made to get an endowment for a Geological chair in Edinburgh, which, we may say, is the cradle of geology—where it took its rise, and flourishes particularly. Unfortunately that attempt was simply snuffed out. We met with a cold reception. In vain did we say that endeavours had been made to endow the University of Edinburgh, which happens to be very poorly endowed; but the efforts and contributions of almost all those who responded to the application have been directed to founding scholarships and bursaries to enable poor students who thirst for knowledge to avail themselves of the knowledge which might be afforded there; and we thought the public purse might well afford a professor to teach that which was really of national importance. I cannot pretend to go through all the different points and sections which are taken up by this Association. I will only call your attention to one which I take some interest in—namely, meteorology. There, great efforts have been made, and with signal success, by the British Association for the advancement of science, more particularly at Kew Observatory. What I and others have urged on the Government of the day is the great importance of having renewed and carried on what were called the storm signals at our different ports. This is of immense value and importance; and I believe much valuable property has been saved, and many valuable lives preserved by the timely hoisting of the drum signifying bad weather. At the Firth of Forth I have seen the drum hoisted indicating tremendous storms of wind, and risks that may be run, and yet not a breath of wind blowing in that particular quarter. Some who had not this simple warning might have said, "We might just as well go out to sea, as there is not a breath of wind here." But then, there comes the newspaper, twenty-four or forty-eight hours afterwards, telling of disastrous gales of winds and shipwrecks upon no very far distant portions of the coast. Well, the great thing I may say with regard to this Association is, that it is not exclusive or repulsive. It will neither expel nor repel others, nor will it seek to include within its sphere other societies that ought more properly to be by themselves. I do not know, gentlemen, that I have any right to trespass any more upon your time—I have trespassed already too long, perhaps. I must, in conclusion, be allowed simply to thank the gentlemen of the British Association for the Advancement of Science for the honour they have done me in placing me in this chair. I know it is no slight honour—I feel it is no slight honour—I also feel it is no slight responsibility—but, so far as in me lies, I will endeavour faithfully to perform my duties, and I hope these duties will not be so performed as to show that you

have been entirely deceived in having selected a person for this high position who was totally unfit to be your choice. (Cheers).

Professor PHILLIPS, in an eloquent and interesting speech, passed in review the progress of the British Association and the work it had done towards the advancement of science during the course of 36 years, and concluded by proposing a vote of thanks to the Chairman for the inaugural address he had just delivered.

SECTION B.—CHEMICAL SCIENCE.

President:—Professor Thomas Anderson, M.D., F.R.S.E.
Vice-Presidents:—Maxwell Simpson, M.D., F.R.S.; Professor Williamson, F.R.S.; J. Lothian Bell, F.C.S.; W. Odling, M.B., F.R.S.; Dr. Gilbert; Professor J. S. Brazier; Dr. Penny. *Secretaries*:—Professor Liveing, M.A., F.C.S.; Dr. Russell, F.C.S.; Dr. Crum Brown, F.R.S. *Committee*:—J. Atfield, Ph.D., F.C.S.; Dr. Barford, F.C.S.; A. R. Catton, F.C.S.; R. Calvert Clapham, F.C.S.; W. Crookes, F.R.S.; John Davy, M.D., F.R.S.; Dr. Heddle; W. E. Heathfield, F.C.S.; P. Spence, F.C.S.; J. Spiller, F.C.S.; E. C. C. Stanford, F.C.S.; Dr. R. Angus Smith, F.R.S.

In the High School.

President's address.

A. R. Catton.—Report on the Synthesis of certain Organic Acid.

A. R. Catton.—On the Synthesis of Formic Acid.

A very animated discussion took place upon these synthetical papers between Professor Wanklyn and Mr. Catton, in which each speaker defended his own views, and attacked those of the other in very energetic language.

J. A. Wanklyn and R. Schenk.—On the Synthesis of Croicic Acid.

J. A. Wanklyn.—Action of Sodium on Valerianic and similar Ethers.

P. T. Main and A. R. Catton.—On a new Synthesis of Ammonia.

J. Spiller.—On the Decay of Stone.

W. Weldon.—On the Regeneration of the Oxide of Manganese.

To-day the sections commenced their regular work. The committee of Section B met at half-past ten a.m., and at eleven the President, Dr. Thomas Anderson, F.R.S.E., opened the proceedings with the following address:—

On many previous occasions the British Association has met in places which have afforded the chemist most valuable opportunities of seeing the principles of his science reduced to practice, and the various papers which have been read at the Section on these subjects, and the discussions which have arisen regarding them, have formed a very interesting department of its proceedings. At the present meeting little of this is likely to engage our attention, for though the manufactures of Dundee have probably increased, during the last ten or fifteen years, in a more rapid ratio than those of any other town in the kingdom, they have taken a direction which gives but little scope for the applications of chemistry, so that with the exception of a few of the simpler operations of the dyer, there is really scarcely anything which need specially attract our attention. Under these circumstances it may be fairly anticipated that the business of the Section will be more particularly occupied with the discussion of the great principles of the science which to the general public are often less interesting, and regarded as the exclusive province of those engaged in scientific study, and not sufficiently recognised as being the only sure foundation on which the superstructure of practical progress can be raised.

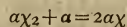
The consideration of these general principles is, however, at the present moment a matter of the very highest importance, for the science of chemistry is in a state of transition. The immense accumulation of facts which has been made during the last twenty or thirty years, has not only increased her bounds, but has shown the

insufficiency of those principles on which the chemist was formerly ready to rely with almost implicit confidence, and introduced changes amounting to a revolution which have had the effect of unsettling the views formerly entertained by almost all chemists, without as yet introducing anything conclusive in their place. The atomic theory, which at the commencement of the present century explained with clearness and precision all the facts of the science then known, has proved itself (at least in the form in which Dalton left it) no longer sufficient for the purpose. At that time the knowledge of chemists was confined to a comparatively small number of compounds, among which those of oxygen had so preponderating an importance that the science of the time might almost be described as the chemistry of oxygen. At the present moment, if we were to attach to it the name of any individual element we should most unquestionably describe it as the chemistry of carbon, for it is in the study of its compounds that all the difficulties with which the chemist has now to contend have had their origin. At a comparatively early period indeed, doubts were expressed as to the sufficiency of the atomic theory of Dalton, and Ampère especially suggested that the chemical atom might with advantage be considered to be a congeries of smaller particles; but this and other analogous additions to the original conceptions of the chemical atom, having no immediate bearing on the facts then, or even now known, have never been accepted by chemists, or received from them more than a very passing notice, and were not unfairly considered to be unnecessary complications of the theory. It was left for time to accumulate facts, for which Dalton's theory supplied no explanation of any kind, and these were at first neglected, but as their number increased, their explanation was evaded by the invention of names intended to group together facts supposed to be dependent on similar causes. Such names as catalysis, allotropy, and the like really explained nothing, they are little better than scientific lumber-rooms, in which unexplained facts are stowed away until it suits our knowledge or our convenience to classify and explain them. I am far from asserting that this mode of grouping facts supposed to have something in common, has not its advantages, provided only it be distinctly understood that it is the grouping of ignorance. The risk lies in the name being accepted as an explanation, and inquiry being thereby retarded, and something of this sort has indeed occurred, for though these facts were admitted to be beyond the scope of the atomic theory, they were quietly set aside; things we t on as they were before, and it was not till the introduction of the theory of atomicity, which shows itself n every chemical fact, that the doubts which had b ien long gathering in the minds of all thoughtful ehemists found distinct expression. I do not on the present occasion propose to discuss in detail the effect w hich the introduction of this view has had upon chemical theory, further than to remark that it renders it necessary either to abandon altogether the atomic theory of Dalton, or to introduce into it such modifications as fundamentally alter its entire character, and make it substantially a new theory. The former is an alternative which some chemists will be greatly disinclined to adopt. They will not willingly abandon a theory which has admittedly done admirable service, which at its first introduction established order and regularity, where confusion and disorder previously reigned supreme, and under whose influence the science has attained its present goodly proportions. Others again may be of opinion that the atomic theory has done its work and in the future is less likely to act as an assistance than as a hindrance to progress, by forcing us to consider all facts in its particular light, and causing us to overlook relations which might be at once detected by an unbiassed mind.

This latter opinion has been very strongly expressed by Sir Benjamin Brodie, and in the calculus of chemical operations, which he has recently made public, we have the

first systematic attempt which has been made to express the constitution of chemical compounds, by a method in which the idea of an atom has no place. As this is the most important chemical doctrine which has been put forward for many years, and must if accepted materially alter our present views, I shall venture to consider it in some detail, premising, however, that as only the first part of the investigation has yet been made public, any opinion I may now express regarding it, may be liable to modification when the entire investigation is published.

Sir B. Brodie, as has been already observed, discards altogether the idea of an atom, and compares with one another the weights of different substances in the gaseous state which are capable at the standard temperature and pressure of filling a unit of space, which is the bulk of 1,000 cubic centimetres. If we consider this space to be empty, and fill it with hydrogen, a chemical operation is performed which is represented by the symbol α , expressing the fact, that the weight so introduced is chemically indivisible. If now in place of hydrogen, oxygen be introduced, the unit of space is filled by a quantity sixteen times as great, but this weight is not indivisible, as is at once apparent if we notice what happens when oxygen is introduced into the unit of space already filled with hydrogen. In that case a second operation is performed on it, in which a weight eight times as great as that of the hydrogen is introduced, and water is the result. The quantity of oxygen which fills the unit of space, must therefore be regarded as divisible, and this is expressed by assigning to it the symbol β , indicating the fact that two identical operations are required to fill the unit of space with oxygen. By the same line of argument it is concluded that sulphur, selenium, &c., must be similarly constituted, and they are accordingly represented respectively by θ , λ , &c. So far it will be observed that the system is merely a modification of that at present used by chemists for expressing the laws of gaseous combination, excepting that all substances, compounds as well as elements, are referred to the unit of space, while, according to our present plan, the former are referred to two units of space, and the latter to one. But when the compounds of chlorine and the allied elements, with hydrogen, are to be represented according to Sir B. Brodie's system, it at once becomes apparent that some further hypothesis must be introduced if they are to be referred to the same volume. When the quantity of hydrogen represented by the symbol α , unites with chlorine, the product fills two units of space, and as, according to the fundamental hypothesis α , is indivisible, the question is to obtain some means of expressing without fractions the quantity of hydrochloric acid, which fills the unit of space. This end Sir Benjamin attains by assuming that chlorine is itself a compound of hydrogen with an unknown element to which the symbol χ is assigned; chlorine being $\alpha\chi$, and formed by these operations, one being hydrogen, and the other two which are identical, result in the introduction into the unit of space of two quantities of a hypothetical substance χ , whose weight is $17\cdot25$, and according to this view, when hydrogen and chlorine unite, the action is expressed by the equation :



On precisely the same principle iodine, bromine, nitrogen, phosphorus, antimony, and bismuth, must also be hydrogen compounds. It is obvious, therefore, that Sir Benjamin's system involves a very large amount of hypothesis, for it assumes that a considerable number of those substances hitherto regarded as elements are really compounds. I do not imagine that much difficulty will be experienced by any one in admitting the possibility of this, for I apprehend there is no chemist who imagines those bodies which we call elements to be the ultimate constituents of matter, or who doubts that the time, though still far distant, will come when they may be resolved into simpler substances. But when we come to reduce these speculations to a

definite form, and seek to make them part of the science itself, it becomes essential to subject them to a very close and searching scrutiny.

In order to justify their assumption, it seems to me necessary either that they should be supported by experimental evidence, or that they should afford the means of tracing out unsuspected relations, and thus extending the bounds of the science, or, at all events, that they should involve the minimum amount of hypothesis. Now, as regards the first of these, it is unnecessary to observe that there is not one tittle of evidence to show that chlorine is a compound any more than hydrogen itself. As far as extending the bounds of the science is concerned, we must look for an answer to the future, and it may be expected that in the remaining parts of the investigation, which it is to be hoped will soon be made public, it will be shown how the method may be used for this purpose; but, in the meantime, I confess I am unable to see how it can be used so as to open up new fields of inquiry, and it is certain that it leaves unexplained all those anomalies which are encountered in the existing system. Neither can it be asserted that the system involves the minimum amount of hypothesis, for, in point of fact, the assumption of the compound nature of certain of the elements is rendered necessary by the fundamental hypothesis that α is indivisible. If it be assumed to be divisible, the necessity for holding those elements to be compound at once falls to the ground, and I confess it appears to me that we should require very clear evidence of the advantages it offers before we accept a hypothesis involving so many others. The question must at best be considered as still *sub judice*, and the method is not likely to meet with general acceptance until it is supported by a much larger body of facts than those we at present have.

While Sir B. Brodie's theory is one from which the idea of atoms is excluded, it is important to notice that it is by no means incompatible with them, and it even appears to me that though it may suit our convenience to consider matter in relation to space only, the real subject of inquiry is not the unit of space, but the unit of matter, and to it we must eventually come. If I hold, as I most undoubtedly do, that the atomic theory of Dalton must sooner or later be abandoned, it is not because I do not believe in the existence of a unit of matter. Whether we assume it to be a hard spherical particle, a centre of force, or a vortex produced in a perfect ether, is another question; but it seems evident that some kind of molecular hypothesis is indispensable for the explanation of physical phenomena, and it is scarcely possible to doubt that some connection must exist between the chemical and the physical unit of matter. In the mean time it is only by the most cumbrous and improbable assumptions that the existing atomic theory can be made to fit in with the facts which chemistry has recently discovered, and of these the theory of atomicity is one which can scarcely be connected with it at all. The fact is that theory is a merely temporary hypothesis, constructed to keep before our eyes the tendency which substances have to form compounds of certain definite forms, under special circumstances; and it is scarcely possible to doubt, that in 20 or 30 years it will have passed away and have been replaced by something of a more satisfactory character. Meanwhile its important influence on the recent progress of chemistry is too obvious to be disputed. It is only to be regretted that so many conflicting modes of considering the atomicities of the elements should have been introduced by different writers. Into the consideration of this matter I should have been glad to have entered at some length, but I feel that I have already detained you too long from the actual business of the Section, and no doubt opportunities will arise in the course of the business for individuals expressing their opinions on this and other subjects. Among these the mode of expressing the symbols of chemical compounds, which was objected to long since by Sir John Herschel, and has been again brought into

prominence by the publication of Sir B. Brodie's paper merits attention. The present unsettled state of chemical nomenclature, so inconvenient to the teacher, ought also to be discussed, and it might even be well to consider whether a committee should not be appointed to ascertain how far it might be possible to adopt a uniform system. Nor do I think we ought to separate without recording our opinion on the subject of better and more extended scientific education. The events of the Paris Exhibition have brought our deficiencies in this respect very conspicuously before us, and show us how much we have yet to do. That we have made progress in this respect is not to be doubted. Science is much more cultivated than formerly,—it is becoming more and more a branch of general education. Much, however, still remains to be done in this direction, especially in Scotland, and it will no doubt surprise many of my audience to hear that chemistry and natural history are still excluded from the course of study for degrees in arts in the Scotch universities. Of late years the study of this and other departments of natural science has been introduced to some extent in schools both in England and Scotland; but, I must confess, with but little advantage, so far as my experience goes. The failure, I think, lies in the kind of instruction offered; the usual practice having been to give a course of lectures from which the discussion of principles and of everything which exercises and develops the mind, is eliminated, and only that which it is supposed will entertain or surprise is retained, and boys are thus led to look upon science merely as a pastime. They are shown enough to see the difference between this and the closer and more severe system of study pursued in the other departments of their education, and they are apt either to avoid work altogether, or to acquire their knowledge in a superficial manner. The whole system of teaching science to school-boys is a subject which merits far more attention than it has yet received, and the success of the movement must greatly depend on the method of teaching adopted. All these, however, are subjects the discussion of which would carry me far beyond the limits of those introductory observations with which it has been customary to open the business of the section. It must be left for its members to bring forward their own views on these and kindred questions.

Professor WILLIAMSON:—I rise to propose the thanks of this meeting to our worthy President for the address with which he has just favoured us. He has touched on several of the most weighty and important matters which are interesting to us as theoretical chemists, and he has very justly remarked upon the very rapid progress which our science has been undergoing of late years, especially in the way in which existing theories have been made or modified. And it is surely a most encouraging proof of the life which is in our science to see, besides the discovery of facts, these immense evidences which have manifested themselves in all directions. Our distinguished President has also touched on a peculiarly interesting topic to all persons, namely, the introduction into general education of those important results which chemists and others have attained in their special departments. It is certainly to be regretted that these results should remain as yet rather unknown in our schools. It is one illustration of the slowness with which we excuse many results of great benefit to see that these great discoveries are not yet introduced into general education; and certainly we owe our President thanks for the formal way in which he has drawn attention to the importance of introducing scientific education into schools.

The practical subjects which we heard treated of with so much interest in his able address are so fruitful and weighty that I am sure the section will concur with our president in a wish that it may form the subject of one of our meetings, and I would venture to suggest that some early day should be fixed for—I was going to say a field day on the subject of chemical theories.

It seems to me that it is one of our strong characteristics that we are quite as much inclined to the practical as well as to theoretical views, and though we are perhaps to have one field day on theories, I hope there will be many such on the more practical questions.

With regard to the practical introduction of science I ought not to omit to mention that we have present to-day a distinguished member who has collected on the Continent a great amount of facts as to the progress of scientific and technical arts, more especially metallurgy and engineering. I allude to Mr. Lothian Bell, and I hope he will favour us with some of the results of his observations on the subject.

I beg to move a vote of thanks to Professor Anderson, and I am sure the section will be glad to see the printed address of our distinguished President.

The following papers were then read:—

"On the Decay of Stone; its Cause and Prevention,"
by J. SPILLER.

For several years past I have been occupied at intervals in studying the causes of the decay of stone, and in experimenting with such chemical reagents as appeared to offer any promise of being usefully applied as means of prevention. At an early state of the investigation I arrived at the conclusion that the corrosive action of sulphurous and sulphuric acids in the atmosphere, resulting from the combustion of coal fuel, operate, in large towns especially, in a very destructive manner upon dolomite and the numerous class of limestones commonly employed in our public buildings. This chemical action, aided no doubt by the simultaneous attack of carbonic acid and moisture, and in the winter season further supplemented by the disintegrating effects of frost, must, I conceive, furnish a sufficient explanation of all the facts observed.

I would here remark that Dr. Angus Smith, Mr. Spence, and others have already directed attention to the immense scale of production of these sulphur acids, and have even quoted statistical data showing the extent or degree of pollution of the air from this cause in the manufacturing districts of Lancashire. When it is known that the *best* class of coal (and coke) contains usually one per cent of sulphur, and that this proportion reaches a treble equivalent when stated in the form of the final oxidised product,—hydrated sulphuric acid,—it follows that a ton of coal of this high quality necessarily evolves during its combustion nearly 70lbs. of oil of vitriol. Here, then, is the origin of the sulphates which we find invariably present in the loosened crust of decayed stones, whether of calcareous or magnesian character. I have tested numerous samples of dolomite, Caen, Bath, and Portland stones fresh from the quarry, and in no instance found more than a trace of ready formed sulphate, whereas scrapings taken from the decayed portions of the stone of the New Palace at Westminster are bitter to the taste in consequence of the comparatively large amount of sulphate of magnesia formed during a few years' exposure to the sulphurous gases occurring in a metropolitan atmosphere. Caen stone from several buildings and localities, Portland stone, and even old faces of chalk cliff in the neighbourhood of Woolwich, were in like manner found to contain appreciable quantities of the sulphate of lime having undoubtedly a similar origin.*

*Caen stone, Northfleet College.

Decayed exterior portion contained of sulphate of lime 3·4 per cent.
Interior of same stone (sound) " " nil.

Caen stone. St. John's Church, Woolwich.

Scales of decayed stone contained of sulphate of lime 4·6 per cent.
Interior portions (sound) " " nil.

The facts now stated have, it is believed, but a minor interest for the inhabitants of these parts of the United Kingdom; for with Aberdeen granite and Craigleith sandstone at command there will be no need to resort to chemical methods of preservation.

The PRESIDENT said: I am sure the Section will agree in expressing their best thanks to Mr. Spiller for his very interesting communications on a subject of so very great importance, which all of us appreciate, whether we be chemists or not. The destruction of so very magnificent buildings as the Houses of Parliament has been naturally looked upon as a most serious question, and we have looked forward with the greatest possible interest to the result of these experiments, so as to prevent further decay. Mr. Spiller's account of the results of his process is, therefore, peculiarly interesting to us, and the observations he made are of peculiar value, inasmuch as they afford us some explanation of the cause of this decay. We can see what is peculiar in the decay, and it shows us how important it is for us to bear this in mind when we are making arrangements such as those in connection with the House of Parliament. At the time when the erection of the building was commenced immense care was bestowed in the selection of stone, and the peculiar magnesian lime-stone was selected because it was found that all the buildings erected with it in the middle ages were in an entire state of preservation. The president concluded by saying that it had now been discovered that the atmosphere and other influences of the city had affected the stone; but Mr. Spiller's communication would be valuable, as his discoveries were of great importance in connection with the processes for the prevention of decay.

After the President's remarks on Mr. Spiller's paper, a very important discussion took place, in which Professor Ansted, Mr. Spence, Mr. Ansell, and others, took part.

The next paper—not in order of reading, but in practical importance,—was

“On the Regeneration of Oxide of Manganese in Chlorine Stills,” by WALTER WELDON.

The author stated that the essential features of the process consisted, firstly, in the use of an artificial oxide of manganese, capable of liberating from a given quantity of hydrochloric acid about twice as much chlorine as could practically be obtained therefrom by means of a 70 per cent native oxide; and, secondly, in a simple method of reproducing the artificial oxide from the “still-liquor.” This recovery of the artificial oxide might be performed in the stills themselves, so that a charge of manganese, once placed in a still, might always remain therein, continually generating chlorine; and not only never requiring removal, but never undergoing diminution of properties, nor suffering loss by waste.

The “still-liquor” produced in this process contained no free acid, but was a neutral solution of protochloride of manganese, mixed only with a little chloride of calcium. The artificial oxide was recovered from this still-liquor by adding thereto an equivalent of lime, and then injecting atmospheric air. Double decomposition took place between the lime and the chloride of manganese, producing chloride of calcium, which entered into solution, and insoluble protoxide of manganese, which the oxygen of the injected air rapidly peroxidized. When the artificial peroxide thus produced had been allowed to subside, and the greater portion of the solution of chloride of calcium in which it was formed run off from it, it was ready to be treated with hydrochloric acid, from which it then liberated chlorine, with reproduction of exactly such a “still-liquor,” as was commenced with. From this point the series of operations described was to be repeated as before,—and so on, continually.

The oxide of manganese so obtained, was hydrated in an exceedingly fine state of division, and it shared with all

such artificial hydrates the property of being far more readily soluble in acids than a hard, compact, anhydrous native oxide. In fact, instead of requiring, like the native oxide, long digestion, aided by heat, in a large excess of acid, the artificial oxide dissolved, even in the cold, and with extreme rapidity, in an equivalent of acid, producing a neutral “still-liquor.” Hence, the full theoretical yield of chlorine could be practically obtained from simple equivalents of acid and oxide, and this with a considerably less expenditure of time, labour, and fuel than the inferior yield obtained by means of the native oxide required. When using a 70 per cent native oxide it was rarely found possible to obtain in the free state more than one-sixth of the chlorine contained in the hydrochloric acid put into the stills; but an artificial oxide of only 55 per cent liberated one-third of the chlorine contained in the acid put into the stills, and in less time, and at a less cost for labour and fuel, than the native oxide required for the liberation of half the quantity. A 55 per cent oxide thus enabled a given quantity of hydrochloric acid to yield twice as much bleaching powder as a 70 per cent native oxide did, saving in this item alone from £5 to £7 per ton of bleaching powder.

This evening Professor Tyndall, F.R.S., will deliver an experimental lecture in the Kinnaird Hall, “On Matter and Force.” This, although addressed to working men, promises to be the most attractive lecture of the meeting. At the same time there will be an artistic and industrial exhibition and soirée in the Volunteer Hall. I have just returned from a private view of this, and consider that it will compare favourably with similar exhibitions at former meetings of the Association. The walls of the large Hall are covered with paintings, ancient and modern, of the most valuable description. Amongst the paintings was an excellent likeness of the late Professor Faraday, but it was perched in such an elevated position that few would notice it. This might surely have taken the place of some of the local worthies on the line.

There are also several excellent photographs exhibited, including specimens of Mr. Woodbury's new micro-photography process, or mode of representing in relief microscopic objects; (these will be described in the chemical section); a very fine example of the Woodbury-type, from a negative by W. Bingham. Mr. Spiller exhibits a selection of military photographs; Mr. H. Butler shows some beautiful photolithographic reductions; and Mr. H. B. Pritchard photographs upon silk, satin, cambric, &c. There are also exhibited a large collection of fossils, shells, fishes and reptiles preserved in spirit, and other objects of interest.

Popular Scientific Information.—Tin Assays.—In the *Mining Journal* of Aug. 17, in a report upon the Missouri tin discoveries, we find the following.—“Professor H. M. Beauregard, a graduate of the Paris School of Mines, writes as follows.” “I have three comparative assays with specimens obtained from the surface of the code. First, from a light to a dark green colour, showing in an unmistakable manner the presence of black tin, exhibiting the same characteristics, as specimens from the tin mines of Saxony. Second, from some specimens of yellow and gray yellow streaks, containing a small quantity of tin; and if we take into consideration their position of the surface, they present very good indications. Third, the brown specimens contain no metal; however, the covering of ‘putty’ which is found very abundant, is of a rich quality, and if we consider that these assays were made in open air, that tin is the most oxidizable of metals, and that it is necessary to obtain a temperature of heat equal to 442° Fahrenheit in order to smelt it into ingots, the object in view, to establish the fact of the presence of tin, is reached”!!

ON THE PRACTICAL LOSSES IN THE BLEACHING-POWDER MANUFACTURE.

By C. R. A. WRIGHT, B. Sc., F.C.S.

THE difference between the amounts of bleaching powder of a given strength obtainable theoretically and practically from a given quantity of manganese ore, depend mainly on three circumstances, viz:—

1. Incomplete decomposition of all MnO_2 used.
2. Loss of chlorine by leakage from the generators, conducting pipes, and powder-chambers, and non-absorption by the slacked lime of all the chlorine supplied to it.
3. Deterioration of the powder made, either by loss of hypochlorous acid from the action of the atmospheric CO_2 , or by conversion of hypochlorite into chlorate and chloride, or other compounds deficient in bleaching-powder.

In practical working, it is very difficult to obtain a good estimate of the several amounts of loss experienced from these three causes; the total loss, however, is readily calculable when the weights of manganese ore and bleaching-powder used and made, and the average percentage of MnO_2 , and available Cl contained therein, are respectively known. Thus, taking 55 and 35.5 as the respective equivalents of manganese and chlorine, 100 parts of manganese ore containing M per cent of "available binoxide" should yield $\frac{71}{87} \times M$ parts of chlorine, and consequently should theoretically give $81.61 \times \frac{m}{n}$ parts of bleaching-powder containing n per cent of "available chlorine."

The following results were obtained as the average losses, in different periods extending over several months each, in a works manufacturing upwards of 70 tons of bleaching-powder weekly.

Average per cent of available chlorine in the powder packed in casks ready for sale.	Average per cent of available MnO_2 in the manganese ore used.	Practical yield: the theoretical being taken as 100.
35.00	64.00	76.8
35.35	66.50	75.7
35.19	66.70	72.8

On the whole, therefore, the total average loss is just 25 per cent of the theoretical yield.

These results were obtained by the "Lancashire" mode of working; i.e. where the chlorine generators, or stills, are formed of flags from 4 to 7 inches thick, jointed together and made tight by a composition of fire-clay and tar, known technically as "Barytes." The average amount of powder manufactured per square foot of surface on the floor of the chambers was 13.5 lbs. weekly; while the ratio of the cubic contents of the stills to that of the chambers was about 8.1 to 100. Out of a 100 parts of chlorine contained in the salt decomposed, upwards of 80 were obtained as yellow muriatic acid of 25° Twaddell (25 per cent of HCl), and 15 in the shape of bleaching-powder.

It was found that the average percentage of chlorine found in samples taken from the floor of the chambers immediately they were opened was about 1 per cent more than the average in the same powder when packed in casks ready for sale, and, contrary to expectation, that this difference was almost exactly the same in hot weather as in cold; the numbers obtained being:—

	Summer months.	Winter months.
Average of samples from chambers	35.09	36.71
" " " casks	34.98	35.71
Difference	1.11	1.00

This difference therefore amounts to $\frac{1.05}{36.4}$ or three parts in 100 on the average for a whole year, and probably represents the atmospheric action on the powder during the processes of packing in casks, &c. Bleaching-powder manufactured in hot weather was frequently found to contain perceptible quantities of chlorate; samples kept in a warm place in sealed bottles were found at the end of some weeks to contain several per cents of chlorate; it was, however, found impracticable to determine the average amount of chlorate found in the process of manufacture.

The physical character of the sifted and slacked lime employed was found to have a great influence on the rapidity of absorption of the chlorine, and on the quality of the powder produced. It was noticed generally that those quicklimes technically called "Fat," (i.e., which slack, rapidly falling to a fine flowery powder,) gave always the most satisfactory results; whilst poorer limes which did not slack so quickly, and yielded a gritty powder after slacking, absorbed chlorine much less rapidly, and gave a bleaching powder deteriorating much more rapidly on keeping. Samples of these two kinds of bleaching powder kept in a warm place under the same conditions acted thus: less chlorate was found in the first kind (Fat lime), and no gas was evolved; more chlorate was found in the second kind, and frequently gases were generated, rupturing the sealed vessel containing the same. On making careful analyses of the limes from which these powders were made, scarcely the slightest chemical difference was detectable, all containing but a few tenths per cent of combined silica; and scarcely any other impurity; physically, however, the former kind attracted moisture from the air very much more rapidly than the other.

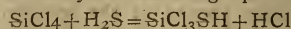
By way of comparison with the foregoing numbers, the following calculations are given, based on data given in "Richardson and Watts's Technological Dictionary," vol. i. part iii. p. 379:—

(1.) 26 cwt of 64 per cent manganese yield 24—26 cwt. of powder of 35—38 per cent of chlorine; averaging, therefore, 25 cwt. at 36.5 per cent. Hence the practical average yield is 61.2 per cent of the theoretical amount.

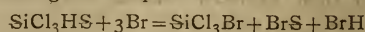
(2.) 2240 parts of salt give 2753 of acid of 28 per cent HCl, and with 448 parts of manganese ore at 60 per cent, yield 416 of bleaching powder at 39 per cent. Assuming the salt to contain, as is probable, 93 per cent of NaCl, out of 100 parts of chlorine contained in the salt, 59.3 are obtained as strong acid, and 12.8 as bleaching powder; the practical yield of powder from manganese being 74.0 per cent of the theoretical quantity.

Chemical Laboratory, St. Thomas's Hospital.

Silicium-mercaptan.—C. Friedel and A. Ladenburg.—Pierre's silicic chlorosulphide, which is prepared by passing a current of hydric sulphide, charged with the vapour of silicic chloride, through a red-hot porcelain tube, the authors find to be a mixture of silicic chloride, and a body of the composition SiCl_3SH . They may be separated from each other by repeated fractional distillations, the new compound distilling between 95° and 97°, silicic chloride at 59°–66°. The reaction by which the silicium-chlorosulphhydrate is formed may be represented by the following equation:



Bromine gives rise to the formation of silicic chlorobromide according to the equation:



This bromide resembles silicic chloride closely; it boils at 80°, and gives off fumes when exposed to air. Its density was found 7.25.

NOTICES OF BOOKS.

The Elements of Natural Philosophy; or, an Introduction to the Study of the Physical Sciences. By CHARLES BROOKE, M.A., F.R.S., Pr.M.S., &c. Based on the treatise by the late Golding Bird, M.A., M.D., F.R.S., F.L.S. 6th edition, 3rd by present author, amended and greatly enlarged. London: Churchill and Sons, 1867.

ALTHOUGH entitled a 6th edition this may be considered in all essential respects a new work, as not only the illustrations and facts, but even the theories adopted are those current at the present time. The author, in an introduction entitled, "On the Nature of Energy and the Correlation and Transmutations of its various Physical Forms," explains the views now held by scientific men in place of the old ideas of imponderable fluids, the conversions of energy from form to form, and the probable mode of propagation of the so-called wave motions through material substances. It is rather unfortunate that in an introduction such as this to a purely scientific work, and immediately after endorsing the opinions of our leading scientific men as to the connection and relations of force and matter, the author should expressly condemn those who would advance science a step further, and by hypotheses such as Darwin's, endeavour to connect the varied forms of life existing around us. If this be presumptuous and beyond the domain of science, who shall say which of the questions treated of in this work are not? Those who persecuted Galileo evidently held the same opinions concerning astronomy, yet they were defeated eventually, as all must be who attempt to impose limits to human knowledge, and would say to it, "Thus far shalt thou come and no further."

With the exception of this passage, which should never have been introduced in a scientific work, and might advantageously be left out in the future editions that are sure to be needed, the work appears a most excellent one, well adapted either to be a manual for the student or a work of reference for the scientific inquirer; a copious index at the end of the volume renders it specially suitable for the latter purpose.

A work of this kind, treating of subjects that are altering from day to day, is naturally valuable in proportion as it includes recent inventions and improvements,—with the older parts of the subject, there are already many means of becoming familiar; the author seems to have taken this view, and acted accordingly; indeed it would be hard to say what invention or discovery of any general interest is omitted. An illustration and a full description of Ansell's fire-damp indicator is given as exemplifying the diffusive power of gases, while the chapter on the principles of mechanism is aptly concluded by a full account of Babbage's difference engine, and that on magnetism includes the various methods of correcting the compass errors in iron ships, and the principles upon which they are applied; none of the methods now employed, however, seem to be quite satisfactory,—at all events, for the first year or so after the ship is built, and before the iron has had time to assume its normal condition. In electricity, especially, we find much new and very valuable matter introduced; *ex. gr.*, Sir William Thompson's beautiful electrometers and galvanometers recently employed in the laying and working of the Atlantic cables; Wheatstone's electric balance and ingenious automatic printing telegraph; Siemens's polarised relay, now so generally used in connection with the Morse instrument; Wilde's magneto-electric machine, and Wheatstone's, Siemens's, and Ladd's modifications; the galvanic cautery, &c.; while the theo-

retical part comprises Ohm's laws, the method used for determining the standard of electrical resistance known as the B A unit, the principles of testing cables, localising faults, &c., and the latest discoveries of Becquerel and Marcus in thermo-electricity.

Where there is so much in the book that is excellent it seems invidious to find fault, but it is difficult to conceive how, whatever mode of classification be adopted, oxygen and hydrogen can be classed together as electro-negative elements, while platinum and potassium both come under the title of electro-positive elements. Whether a body be positive or negative, of course depends upon the substance it is compared with, and the fluid in which it is immersed; but in no fluid ever tried will oxygen and hydrogen, platinum, and potassium, appear other than at opposite extremities of the scale. The extent to which a body is positive is usually considered to depend on its affinity for oxygen, water being the exciting fluid; but here the author, if we understand his table rightly, would actually make hydrogen negative to platinum! It is true the author states in explanation that many of the elements are arranged according to their chemical analogies, still the chemical dissimilarity between oxygen and hydrogen is certainly as great as the electrical.

The latter portion of the book is devoted to the consideration of light and heat, both of which forces have lately received much attention from our leading scientific men. Spectrum analysis, and the wonderful discoveries, terrestrial and celestial, effected by its means, forms a very interesting portion of the chapter on light, and is illustrated by diagrams of many of the more curious spectra of substances and celestial bodies; the difficult subject of polarised light is also very fully dwelt upon, and the generally received theories to account for its phenomena are clearly explained.

The chapter on heat contains a great amount of new matter, comprising the recent researches of Professor Tyndall on the powers of absorbing radiant heat possessed by various bodies; in treating of regelation however, the author seems rather to have misunderstood the explanation of the phenomenon recently arrived at by the experiments of Professor Tyndall when he speaks of it as a "plastic property of ice," and says, "This action is probably analogous to the welding of two pieces of iron, depending on a plastic or viscous condition of the immediate surface, intermediate between the solid and the fluid states." This explanation is contrary to the meaning of the term "regelation," and, though at one time it was commonly received, later researches have satisfactorily proved it to be erroneous. With the exception of one or two passages, like those we have mentioned, which are not of very great importance, and may readily be corrected in a future edition, the work appears carefully written, and the views enunciated such as are now held by our leading physicists; as a book of reference, therefore, it will be found extremely valuable, and may, we think, be very safely depended upon.

Tables of the Spectra of Metals from the Original Drawings. By C. KIRCHHOFF and R. BUNSEN. London: W. Ladd, Beak Street, W.

We have received Table 2 of this set of spectra diagrams. The characteristics of the various elements are shown very clearly, the field being about two feet in length. The spectra of indium, carbon, boron, manganese, lead, copper, cobalt, nickel, and iron are exhibited in this diagram, as obtained from their chlorides. The colouring is good, and in most cases the bright lines represent the actual spectra better than could be expected by those who have experienced the difficulty of imitating the spectrum by aid of a paint-box.

CORRESPONDENCE.

CO-OPERATIVE CHEMICAL CLUB.

To the Editor of the Chemical News.

SIR,—I was very much pleased with Mr. Durham's letter in your last number, as it embodies an idea that had many times flitted before my mind without taking any tangible form. There are many, no doubt, who would be glad to avail themselves of the privileges of a Chemical club, with a laboratory and library attached, and if such were started in this city by a few influential gentlemen I believe it would be self-supporting and be the means of reviving a taste for scientific pursuits that I fear is now much upon the decline.

In the metropolis no doubt there are some establishments of the kind, but in smaller cities no such advantages are to be obtained, and those who wish to pursue experimental chemistry must fit up a room in their dwelling-houses, which as they are constructed in these modern times, are quite unsuited to the purpose, and a source of inconvenience. I trust, Sir, you will give this question the assistance which your valuable paper affords, and that much good fruit may come of it.—I am, &c.,

INQUIRER.

THE PREVENTION OF BRIBERY.

To the Editor of the Chemical News.

SIR,—With your permission I will now endeavour to show how the bribery and corruption described in my former letter on "the tricks of Trade" may be, to a great extent, prevented. Firstly, all travellers who solicit orders should be told—The only condition on which we can do business with you is that you give no gratuities to our men. They have not, in our establishment, the power of selecting wares. A corresponding intimation should be given to every foreman on his engagement. I should even suggest the formation of a protection society among master dyers, printers, etc., in which the names of all detected offenders—whether givers or receivers of bribes—should be confidentially circulated.

Secondly, all mordants, colours, etc., on arrival, should be delivered, not into the dye-house, but into a ware-room, to be issued out to the dyers from day to day, as may be requisite. The books of the establishment will then show, with tolerable accuracy, how much of any particular ware is needed for dyeing such and such goods; and any intentional waste, such as pouring the contents of a bottle down the sink, will be at once detected.

Thirdly, all wares should be carefully weighed upon arrival—a step frequently omitted, lest the warehousemen should be bribed to pass deficient weights; this process should from time to time be watched by the master, manager, or head-clerk. All packages should likewise be tared as soon as empty. Bottles of liquids should be tried with the hydrometer, to see whether they have all the same, or nearly the same specific gravity. Any package or bottle which appears to have a private mark or sign upon the label should be at once impounded for further examination.

Fourthly, the dyer using any lot of ware should be called upon to give his opinion in writing as to its quality. These papers should then be carefully preserved. If the dyers can be kept in the dark as to the precise number of bottles, etc., arriving from any place on a given day, so much the better. But the main method for frustrating bribery is exemplified in the following incident:—A foreman dyer had long been complaining of the extract of quercitran-bark supplied. To put him to the test the maker was requested to obliterate all marks of ownership on a cask, to

fill it with the very same extract, and send it by a strange cart. This was done, and the extract was pronounced excellent, and nearly double in strength to the previous lot! If a dyer is suspected of praising a bad article or condemning a good one, out of corrupt motives, ply him with samples merely numbered, or marked in cypher, and require his opinion as to their comparative value. If he has not been acting honestly, he cannot avoid committing himself.

These recommendations will doubtless involve a little trouble at the outset, but if perseveringly acted upon I feel confident that they will abate, if not destroy the evil in question. I know that honest dyers and manufacturing chemists will be very happy to co-operate in the proposed measures.—I am, Sir, yours, &c., W.

MISCELLANEOUS.

The Atmosphere of the Metropolitan Railway.—An inquest was held on Friday last on the body of Elizabeth Stainsby, who died very suddenly while travelling on the Underground Railway. This is the third sudden death on the line within a few weeks. Previous to entering the Bishop's-road station she complained of a pain in her chest. Upon reaching the platform she remarked, "It is a very nice station, but it feels very hot." As soon as the train started she exclaimed, "Dear me, what a dreadful smell there is," and these were the last words she uttered. When they had proceeded some distance into the tunnel she seemed to suffer great inconvenience, and fell sideways, with her head upon the shoulder of her companion. After leaving Gower-street station she struggled and gasped a great deal, but upon reaching King's-cross she sank apparently fainting. Although Farringdon-street was her destination, she was at once removed to the waiting-room at King's-cross, and a medical man was sent for, but it was found she was quite dead. Dr. Popham, who made a *post-mortem* examination, when pressed to state whether, in his opinion, the atmosphere of the Underground Railway had hastened death, declined to give a decided answer. He had no doubt, however, that air containing a large quantity of sulphurous acid gas and carbonic acid gas would hasten the death of a diseased person. The companion of the deceased stated that the atmosphere of the tunnel between Portland-road and King's-cross was particularly oppressive. In accordance with the strong opinion of the jury, the coroner adjourned the inquiry for the purpose of obtaining the result of a chemical analysis of the atmosphere of the tunnel. We since learn that the directors of the Metropolitan Railway being anxious that the facts should be inquired into by competent and impartial persons, so as at once to remove all possible cause for anxiety, have requested Dr. Letheby, the medical officer of health for the city of London, in conjunction with Dr. Whitmore, the medical officer of health of Marylebone, and Dr. Bachhoffner, to report to them, after a thorough investigation upon this subject, and those gentlemen are now engaged upon the inquiry.

New Mode of Anatomical Research.—Professor Braune, of the University, Leipsic, has just published a method of making accurate drawings of the human system, which is at once novel and startling. He first freezes the subject to a metallic hardness by exposing it to a temperature many degrees below zero for a sufficient period of time, then with a fine saw he severs the frozen body in any direction as may be desired. If proper saws are used, these cuts will be perfectly clean and smooth; over these cuts a stream of water is poured, which instantly freezes, as the whole operation is carried on in a room at a low temperature, and the ice forms a sort of transparent coating to the severed surface, revealing very distinctly every part and outline.

Temperature required for forming Fusible Combinations, and for Melting the same.—C. Schinz. Schinz finds by application of a thermo-electric pyrometer, that silicates are formed and melted at the same temperature, and that the formation of the silicates depends more on time than on temperature, *i.e.*, it depends, in fact, on the conducting power of heat, which the materials composing the silicates possess. He also finds the temperature required for melting metals and metallurgical products to be lower, as formerly has been stated by Plattner. The latter states that a temperature of $1,789^{\circ}$ — $1,876^{\circ}$ C. was required for forming silicates of iron, and of $1,431^{\circ}$ — $1,445^{\circ}$ for melting the same. Schinz now finds that a temperature of $1,000^{\circ}$ — $1,156^{\circ}$ C. is sufficient for both purposes. He also finds that a temperature of a glass-furnace in operation is only $1,100^{\circ}$ — $1,250^{\circ}$; that crystal glass is worked at 833° , and becomes completely liquid at 929° . A Bohemian green glass tube softens at 769° , and becomes liquid at $1,052^{\circ}$. Pure limestone loses its carbonic acid by heating for several hours at a temperature of 617° — 675° C. An increase of the temperature will shorten the time.—(*Dingl. J.*, bd. 182, p. 206.)

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Kunst und Gewerbeblatt. May.

"On the Crystallization of Glycerine and on the Action of Impure Glycerine on the Skin." R. WAGNER, "On the Quantitative Estimation of Essence of Mirbane (Nitrobenzol) in Oil of Bitter Almonds."

Journal für Praktische Chemie. April 25, 1867.

H. KOLBE, "Remarks on Heintzel's Memoir on Triamidophenol." BÖTTGER, "On the Use of Antimony in Voltaic Batteries." F. HOPPE-SEYLER, "On the Presence of Indium in Wolfram." P. SCHOTTLANDER, "On Hyposulphite of Platinum and Soda." F. BAUMSTARK, "On the Action of Oxochloride of Sulphuric Acid on certain Organic Compounds." A. LIELEGG, "On the Spectrum of the Flame from Bessemer Converters."

May 9.

R. HERMANN, "On the Atomic Weight of Tantalum, and on the Composition of the Compounds of that Metal." "On a Double Fluoride of Antimony and Arsenic." T. PETERSEN, "Contributions to the Theory of Leblanc's Process." "A. C. OUDEMANS, "Experiments on some East Indian Fats and Oils." "Experiments on Palm Oil from Surinam." W. F. GINTL, "A new Pinch-cock for Stopping India Rubber Tubes." H. HLASIWETZ, "On Hydrocafeic Acid." G. TSCHERMAK, "On Glaucoctite, Danaite, and Arsenical Pyrites."

May 24.

J. G. GENTLE, "On C. Friedel and J. Crafts' Paper, or a new Alcohol in which Carbon is partly replaced by Silicium, published in the *Comptes Rendus*, vol. 61, p. 792." "On the Boiling Points of Ethers and Alcohols, and of the corresponding Sulphides and Sulphhydrates." "On the supposed Identity of Benzylamine and Toluidine." "On the Similarity of the Behaviour of Carbonic Oxide and Nitrous Oxide in Chemical Compounds, where they replace a Base or an Acid." C. F. SCHONBEIN, "On the Accelerative Action of Liquid Hydrocarbons and other Bodies rich in Carburetted Hydrogen on the Oxidation of Absolute Alcohol, and on the Formation of Peroxide of Hydrogen which accompanies such Oxidation."

Monatsbericht der Königlich-Preussischen Akademie. Feb., 1867.

J. BERNSTEIN, "On the Duration of the Negative Variation of Nervous Currents." R. WEBER, "On some Compounds of the Chlorides of Platinum and Gold." DOVE, "On the Combination of Prismatic Colours to White." "On the Production of Accidental Colours by the Electric Light." "On the Inversions which occur on looking at Drawings in Perspective and Transparent Objects with one or both Eyes." "On the Polarisation of Light by Repeated Reflection." POGGENDORFF, "Observations on Holtz's Electrical Machine." "On a new Electrical Machine invented by Holtz."

Journal des Fabricants de Papier. May 15, 1867.

E. BOURDILLAT, "On Testing the Chemical Products used in Paper Making." J. NICKLES, "On E. Porion's Method of Utilizing Spent Lyes and other Waste Products of Paper Mills."

Archives des Sciences. May 23, 1867.

M. MICHELI, "On the Colouring Matter of Chlorophyll." L. DUFOUR, "On A. Fick and J. Wislicenus' Paper on the Production of Muscular Force." "On Franklin's Paper on the same Subject."

NOTES AND QUERIES.

Manufacture of Sulphurous Acid.—Sir,—Any readers of the CHEMICAL NEWS will greatly oblige the writer if he or they could inform him when using the coke tower, or condenser at the end of sulphuric acid chambers if—1st. The gas that is passing out of last chamber should be dark. 2nd. The acidulated water can be used in chambers. 3rd. (If possible) the quantity of water required to condense the residual gases. A. early answer will greatly oblige—A SUPERVISOR OF CHAMBERS."

Plumbic Chloride.—Sir,—In my paper on the "Solubility of Plumbic Chloride" I find I have made a slight mistake in the specific gravity of HCl, it ought to be 1.16 not 1.116 . I should have noticed it before, only I was away from home at the time it appeared.—J. CARTER BELL.

Prevention of Dry Rot.—Sir,—The enquiry of "Mr. T. H. L." in No. 403, has not reached me until now, owing to my absence from home. The timber should be in contact with the waste. The latter may not be very easily obtainable in London; at least I am not aware of the existence of any alkali works there. If required in large quantities, the waste might be shipped from Newcastle or Liverpool.—G. LUNGE.

Platinizing Metals.—Sir,—I find great inconvenience from the brass-work of my balance and other instruments being attacked by acid vapours in the laboratory. Some years ago I remember seeing beams and pans of balances which had been coated with a brilliant and coherent layer of platinum, I believe by electro-deposition. Can any of your courteous readers kindly give me directions to prepare a platinizing solution, and tell me what strength of battery is required?—OLINTHUS.

The Word Aneroid.—Sir,—Can any of your correspondents tell me the origin of the word *aneroid* as applied to a barometer? What I want is not a conjectural derivation, or an "I have always taken it to mean," or "to come from," but who was the originator of the name, and what was the sense that he put upon the word? The history of the invention might, perhaps, supply some portion of an answer. A Frenchman, somewhere about 30 years ago, is said to have been the inventor.—K.

TO CORRESPONDENTS.

A. B.—Apply to Mr. Griffin, Garrick Street.

A. Dyer.—Use peach or Brazil wood for the colouring agent.

C. R.—You can so easily obtain the information by consulting any elementary work on chemistry, that we really must decline to occupy so much of our space as answers to your seventeen queries would require.

F. H.—Böttger's method of preparing chloride of platinum will be found in our 11th volume, p. 168.

J. Mandella.—Mix white of egg with the solution; boil and strain; the precipitate will contain what you want.

G. M. A.—Not an article of commerce yet.

N. A.—Picric acid frequently contains a little nitric acid as an impurity. This has attacked the paper. Pure picric acid will not affect paper.

Pharm.—Balm of Gilead is the produce of the *Balsamodendron Gileadense*. The genuine balm is very scarce.

Edward D.—You will find a muffle very convenient for incinerating animal matters. Put the body whose ash you wish to obtain in a platinum dish, and this in a muffle heated to bright redness.

An Old Reader.—By this time you will have received an answer by post.

M. Fleming.—Soak the agate in warm oil of vitriol for some days. This will frequently bring out the bands and markings with great distinctness.

O. Dragon.—If you send the price in stamps to our publisher the book will be forwarded by post.

Inquirer.—The colouring matter is peroxide of iron. Our correspondent will perceive that it is unreasonable to expect us to perform a quantitative analysis simply to oblige an anonymous writer. The Editor is always willing to assist correspondents in difficulties, and never objects to try laboratory experiments, or even perform simple analyses in cases where it would appear that the information so obtained would be of real value; but the carrying out of a research which would occupy several days is more than a correspondent should fairly ask. By referring to our advertising columns the names of several gentlemen may be seen who will be willing to undertake the analysis professionally.

Communications have been received from Victor Cruse; Dr. Philson; Rev. R. C. Douglas; Charles Tomlinson (with enclosure); M. A. Baines; George Hopwood; John Heywood (with enclosure); J. C. Wilson (with enclosure); Edwin Smith (with enclosure); G. A. Keyworth; J. C. Wilson; John Bray, F.C.S.; E. Ellis; W. Simmons; P. J. Worsley (with enclosure); W. Ladd; F. C. Calvert and Co.; J. Horsley (with enclosure); J. Harry Taylor; A. Scott; Watson Smith; D. J. O.

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SUPPLEMENT TO THE CHEMICAL NEWS.

VOL. XVI., No. 405.

ON SOME USEFUL APPLICATIONS OF CHLORIDE OF CALCIUM.

By J. HARGREAVES.

THE utilisation of waste products has within the present century become an object of great importance, and the results such, for instance, as obtaining ammonia, benzol, aniline and its derivatives, &c., from coal-tar; garancin from madder waste, acetic and oxalic acids from sawdust and other ligneous materials, ammonia, animal charcoal, and manure from bones, have been sufficiently profitable to encourage further attempts in the same direction. The writer hopes that the following may result in directing attention to some of the means of utilising another waste product.

There is produced in the manufacture of soda by Leblanc's process a larger quantity of hydrochloric acid than can be utilised. The principal use to which it is applied is for the production of chlorine in the manufacture of bleaching powder, but this uses up only a comparatively small proportion of the total production; and many alkali manufacturers throw away nearly all the hydrochloric acid made by them, causing a great amount of mischief in the streams into which the acid is run, in many instances completely ruining them as fishing streams, while the conduct of the luckless manufacturer who can find no better use for his acid, is commented upon by anglers and the lovers of fish diet, in language more remarkable for force than refinement: the former find their sport ruined, and the latter their favourite article of food destroyed.

This acid instead of being thrown to waste can be used to produce chloride of calcium by filling the condensing towers with limestone instead of coke, adding more stone as it is dissolved away by the acid, thus supplying a quantity of chloride of calcium almost unlimited. Or the chloride of calcium may be produced by the reaction of hydrochloric acid on alkali waste in suitable apparatus, and using the sulphuretted hydrogen given off, in the manufacture of sulphuric acid. There are practical difficulties in the way of adopting this mode of making chloride of calcium, but are they impossibilities? The chief difficulties are that unless great care is taken there is an escape of sulphuretted hydrogen which is not only very disagreeable but is liable to explode when mixed with the atmosphere. Great care is also required when burning sulphuretted hydrogen, for if the supply of air is deficient, sulphur is sublimed and passed into the vitriol chambers unburnt and if the supply of air is for a short time cut off, sulphuretted hydrogen is liable to get into the chamber and cause an explosion on the admission of an excess of air afterwards. In fact, making sulphuric acid by the use of sulphuretted hydrogen has after many trials by various inventors been found to be one of those matters which become dangerous and impracticable in the hands of ignorant workmen (another illustration of how the ignorance of a population restricts the sources of wealth in a nation).

Another cheap source of chloride of calcium is to be looked for in the bye products from several other processes for the recovery of sulphur from alkali waste, such, for instance, as that of M. Mond, a description of which lately appeared in the CHEMICAL NEWS. The chloride of calcium has in this case the advantage of being free from arsenic, the arsenic being precipitated along with

the sulphur as tersulphide. Another ready source of chloride of calcium exists in the bicarbonate of soda manufacture; the chloride is obtained when limestone is acted upon by hydrochloric acid for the production of carbonic acid.

The chloride of calcium by whatever means obtained, should, if it has to be carried to a distance, be boiled to dryness in a reverberatory furnace, and the heat urged till the chloride is in a state of igneous fusion, then drawn into suitable moulds, and when cold it is in a fit condition for packing and transport. It should be packed so as to be protected from the air, on account of its deliquescence.

One of the most prominent reasons why the collection of manure by sedimentary deposition from sewage is not practised, is, that the greater portion of the manurial ingredients, and among them a great proportion of that most important one, phosphoric acid, are held in solution, while the least valuable are contained in the sediment. Chloride of calcium added to town sewage causes the precipitation of phosphoric acid from the soluble phosphates. The compounds of nitrogen are not, however, precipitated except in a very small proportion, and are therefore lost, when only the sedimentary portion of the sewage is used, but this is of little importance compared with that of the loss of the phosphates, as the atmosphere will in time supply to plants sufficient hydrogen, carbon, oxygen, and nitrogen, though of course the latter elements will not be so rapidly assimilated by the plants, as would be the case were they supplied with the manure; but the mineral elements if once exhausted can only be re-supplied by artificial means. Chloride of calcium added in excess to sewage also exerts antifermentative and antiseptic properties, retarding the decomposition of the organic portion; and when fermentation does occur, the evolution of the nauseous and poisonous sulphide of ammonium produced by the decomposition of organic compounds of sulphur and nitrogen, is prevented, by production of chloride of ammonium and sulphide of calcium,* $\text{NH}_4\text{S} + \text{CaCl} = \text{NH}_4\text{Cl} + \text{CaS}$. And when carbonate of ammonia is produced by the decomposition of compounds of nitrogen, from which sulphur is absent, or fixed by other combinations, the evolution of ammonia is prevented by the formation of the less volatile chloride of ammonium $\text{NH}_4\text{OCO}_2 + \text{CaCl} = \text{NH}_4\text{Cl} + \text{CaOCO}_2$. The addition of the chloride is an effectual preventive of the evolution of compounds of ammonia from stable manure and from cesspools. These properties make chloride of calcium an effective agent in preventing the waste of phosphoric, and, in some cases, ammoniacal compounds, and are well worthy the attention of agricultural and sanitary reformers.

When esparto or other vegetable fibres are used in the manufacture of paper, a solution of caustic soda is employed for dissolving out the resinous and gummy portion of the vegetable from the fibre. The waste lye produced by the operation is allowed to run off in the form of a deep brown-coloured liquid, and consists of extractive matter, and resinous and fatty substances, combined with soda in the form of soap, together with carbonate of soda, caustic soda, and notable quantities of phosphate of soda. All these soda compounds are decomposed by chloride of calcium, causing the formation of corresponding lime compounds and chloride of sodium. The lime compounds being insoluble, are precipitated, carrying with them a large proportion of organic extractive matter, leaving the water with comparatively little colour, and by converting the soda present into common salt, depriving it of many of those noxious qualities which cause paper works to be regarded with such disapprobation when situated on the banks of fishing streams. The precipitate contains all the elements of an excellent manure; its principal disadvantage is owing to the great quantity of water adhering to

* This and the succeeding reactions are inverted when the materials are heated.

it, which renders it difficult to remove, and dilutes the manure; but a little practical experience will remove this objection—perhaps spreading it in shallow layers to dry and drain might make it sufficiently concentrated. The chloride of calcium has, in practice, to be used in excess of the quantity theoretically necessary; that excess, however, does not perceptibly injure the water for supporting life in aquatic plants and animals.

On the one hand, the streams of one part of the country are polluted with a powerful alkali, and in another with a corrosive acid; in both instances the streams are unfitted for supporting animal life. In many cases rivers once abounding in salmon, trout, and other valuable edible fish, are now deserted in consequence of these pollutions. All that is required to put an end to this state of things is to use the one to neutralise the other, and produce a harmless neutral salt, and, at the same time, prevent our manurial wealth leaving us by being carried to the sea.

The writer has not at hand the means for forming a correct estimate of the quantity of chloride of calcium that might practically be obtained; but it is evident to any one having any acquaintance with the immense manufactories of soda on the Tyne, the Clyde, and the Mersey, that many thousands of tons of chloride of calcium per annum may be obtained, and the precipitation that of phosphate of lime from sewage, and the use of that precipitate as manure, would go far to supplement or supersede the phosphates imported in the form of guano and bones. All the materials used in its manufacture are cheap and abundant, in some instances costing less than nothing, inasmuch as some of them have at present to be removed out of the way at great expense of carriage and space in which to deposit them.

Appleton-Widnes, Aug. 19, 1867.

NOTES ON CRYSTALS DEPOSITED FROM THE BRAIN.

By S. W. MOORE.

In the month of June this year (1867), Mr. Stuart, curator of the Museum, St. Thomas's Hospital, called my attention to the fact that he had noticed in some of the brain preparations a deposit of crystals which appeared to him to present a very beautiful and unusual appearance; he thought, perhaps, that I might like to examine them chemically, which I have done, thinking the results may lead to facts which will ultimately throw some light on the now very imperfectly understood compounds of the brain.

On inspecting a jar containing the deposit, there was found a very thick layer of crystals at the bottom, which upon further inspection were seen to have the form of rhombic plates; over these, however, there was a layer of what might have been mistaken for mucous or brain matter, but on examination with the microscope they presented a very beautiful appearance, two or three



distinct forms being apparent, viz.—*a*, small stars, formed of globular bodies (of which there were seven, six aggregated round one), a little smaller than the male human blood corpuscle. *β*, resembling two pieces of tape, one in a semicircle, the other stretched across its diameter, the ends on both sides being twisted. *γ*. This form was one piece only, its ends being brought round upon one another and twisted.

These strange forms suggested the idea that some

albuminous principle might probably have united itself with a crystalline substance, and have caused these structures to become manifest in the attempt to crystallise; they gave under the influence of polarized light a distinct cross, and what seems to confirm the supposition of their being a colloid is that upon testing nitrogen was developed. They are saponified by KHO, and dissolved by hot absolute alcohol, and separate out on cooling in a granular form, and are of course insoluble in water.

On presenting the various tests to the crystals which were so densely crowded at the bottom of the vessel, some very interesting data were collected, agreeing with the tests for no other hitherto mentioned brain compound.

In appearance the crystals were waxy, they were tasteless and insoluble in water; on ignition they burned away with a bright smoky flame, leaving no residue whatever. The tests for N, P, and S, were carefully applied, but with no result; the substance was precipitable from its ethereal solution by alcohol; its melting-point was 103°C ., and on combustion it gave the following percentage:—

Carbon	43.79
Hydrogen	8.09
Oxygen	48.12 by difference.
	100.00

From this an empirical formula may be calculated, having the following constitution, $\text{C}_7\text{H}_{16}\text{O}_6$, or $\text{C}_{12}\text{H}_{26}\text{O}_{10}$, the latter perhaps giving a calculated result nearer the found one, viz.,—

Carbon	43.64
Hydrogen	7.88
Oxygen	48.48
	100.00

From the results obtained above we may safely conclude that the substance is not cholesterine, its high percentage of oxygen, and its low melting-point, excluding it from that supposition. It is equally impossible that it should be cerebrie acid, because it is perfectly neutral and contains no nitrogen, the absence of phosphorus proves it cannot be oleophosphoric acid.

I hope to obtain some more of the substance, when further experiments will be made, from which I shall doubtless obtain something of a more definite nature, and be enabled to give it a rational formula, it appearing to have been up to the present time unnoticed.

On exposing to the air the spirits from which the crystals had been taken, a fresh crop formed; these, however, were only crystalline plates of cholesterine.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

AUG. 26, 1867.

(FROM OUR OWN CORRESPONDENT.)

Death of Dr. Velpeau.—Fleurine.—M. Charles' Manuscripts.

A gloom was cast over the assembly by the death of the celebrated Doctor Velpeau, born on 18th May, 1785, at the village of La Briche, in Touraine. The son of a blacksmith and farrier, whom he aided in his trade, he became acquainted with the first notions of veterinary surgery. In 1816 we find him at Tours, a medical student; and in 1820 at Paris, where he was made doctor three years later. Laborious and tenacious, he rapidly amassed money, especially as his private practice was confined to the higher aristocracy. As hospital surgeon of the Pitié, as professor, as academician, he led the example of punctuality,

assiduity, and practical skill in conducting operations, so that he became at once one of the best surgeons of France. In 1842 he was elected to the vacant chair at the Institute, having been previously, in 1835, nominated, though he had for a fellow competitor the celebrated Lisfranc. His titles were: Surgeon to the Charité, Member of the Institute, and of the Academy of Medicine, Commander of the Legion of Honour, Professor of Medicine, and Consulting Surgeon to the Emperor. The numerous works written by him are not so easily enumerated; we have before us the list of 18, most of which are in several volumes and accompanied with atlases and magnificent engravings; without counting all the valuable papers read at various Societies, they prove that he wielded the pen as steadily as the bistoury, or the hammer on the anvil, in his early days.

Surgical and medical science have lost latterly many in their front ranks; Malgaigne, Jobert, Cirale, Trousseau, Charrière, and last, Velpeau. Funeral discourses were pronounced by Nelaton, Riche, Gosselin, Husson, Guyon, and Longett; the latter was pupil and friend of the deceased.

Among the correspondence, which was opened by M. Chevreul, was an important one on fluorine, by M. Pratt. According to this chemist we have been hitherto mistaken upon the composition of fluorides, and on the theory of fluorine. M. Pratt proposes new formulæ, which harmonise better with known analyses. These will be examined in detail when the *Comptes Rendus* appear.

M. Balard presented a note on chloride of ethylene.

M. Blanchard reminded the assembly that at the last meetings of the Academy doubts were expressed upon the existence of unpublished manuscripts of Pascal, which would contain important discoveries. He thinks that these doubts ought to be satisfied by a declaration contained in a passage of the preface of the "Treatise on the Equilibrium of Heavy Liquids," published in French. M. Blanchard states that this preface was probably written by Madame Perier. The edition in the hands of M. Blanchard is dated 1698, and is conformable to those of 1663 and 1664.

M. Faugère having been invited by the president to state his objections against the authenticity of the documents published by M. Chasles, stated that the falsificator had not even well imitated the handwriting of Pascal. He said that the forger was merely satisfied in adopting the writing and style of language of the 17th century.

M. Faugère confined his observations to mentioning an anachronism, according to him, most evident. There is a question, in one of the letters, on the froth of coffee; now, the use of coffee was not introduced into France before the end of the year 1669. He contested that Newton never wrote in French, also he remarked upon the common-place style of the letters attributed to Pascal, whose diction was far different, and added that the forger was caught in his own net. He hoped that the imposition upon M. Chasles would be shortly cleared up.

M. Chasles replied that all these doubts have not shaken his confidence in the authenticity of his documents, so numerous and varied.

M. Regnault observed that photography would furnish the means of recognising whether the old papers contained anterior writing that may have been made to disappear. Also there are chemical reagents calculated to revive effaced writing.

M. Chasles declared that he would place at the disposition of the Academy all the letters and documents to be submitted to all manner of tests.

M. d'Abbadie presented on the part of M. Radau a note on the ancient meteorograph and on the theory of the barometer of M. Moreland. We find in the *Journal de Physique* of the Abbé Rozier (1782), a memoir of Magellan, giving a description, accompanied with plates, of a "Perpetual Meteorograph." Seven instruments trace parallel curves on the same diagram, moved by clockwork. The pressure is registered by a wheel barometer, the temperature by a metallic thermometer, and the humidity

by a hygroscope constructed of wood; the force and direction of the winds are obtained by a very ingenious anemograph; rain, evaporation and the height of the tides are indicated by apparatus furnished with floats. Nothing is wanting, and in several respects this meteorograph is superior to those recently constructed. The steel yard barometer was invented by Sir Samuel Morland, who presented it towards 1670 to Charles II. Magellan possessed a barometer on this principle, constructed by Jonathan Sisson; he improved the mode of suspension. Later, in 1791, the Rev. Arthur M'Quire le transforma en barographe en attachant un crayon au sourmet du tube (*Transactions of the Royal Irish Academy*, vol. IV.) The theory of the barometer, complicated enough, was not as yet given exactly.

SEPT. 2, 1867.

Death of Faraday.—Godard and Savigny Prizes; Father Secchi on Shooting Stars.—Stellar Spectroscopy.

A letter from Mr. Dumas informed the Academy of the loss it has just sustained by the death of Mr. Faraday, one of its foreign associates. M. Dumas made this mournful communication at the request of M. Tyndall, who thought that M. Dumas could, as one of the friends of the illustrious deceased, replace, in the performance of this duty, his family.

M. Chevreul, after having read this letter, added that all the members of the Academy would certainly participate in the sentiments it expressed; he paid a solemn homage to the memory of the great English physicist, and related several facts which manifested his modesty, and the nobleness of his character.

The correspondence included some documents on the definitive disappearance of the great birds of Madagascar (*Epiornis Maximus*), and on the work of MM. Burden and Bourget, on heat, &c.

M. Chasles replied to the criticisms of M. Faugère. He commenced by enumerating again the very important and varied documents in his possession, among which are about 1,000 documents of La Bruyère (nearly 300 letters, a key of characters, the same which circulated at that time among the intimate friends of La Bruyère, and many other isolated pieces). M. Chasles combated, one by one, the objections raised by M. Faugère, apparently successfully. He remarked how very improbable it was that a falsificator could fabricate such an immense number of documents of a nature so different. He must have had a great imagination!

M. Chasles cited letters from Desmaizeaux to Fontenelle, in which there is doubt of the relations between Newton and Pascal; they say it was the professor of young Newton who wrote his letters. M. Bertrand remarked how singular it was that no allusion is made to this in Fontenelle's *éloge* of Newton. M. Chasles replied that Fontenelle had requested of Desmaizeaux information as to the youth of Newton before he wrote his discourse. Desmaizeaux, in his reply, said that he possessed Newton's papers, but that his family had confided them to him on the condition of not making use of them. "I will give you," he said, "notes, but which will not injure the reputation of M. Newton, so well re-established." Fontenelle submitted to Desmaizeaux his project of *éloge*, and the latter prayed him not to revive old souvenirs nearly forgotten. Leibnitz knew all these things; he avowed that he had papers of Pascal, but that he makes no mystery of them, like M. Newton.

A commission was appointed for the Godard prize, and another for the Savigny prize, founded by Mademoiselle Lettellier, in favour of young travelling zoologists.

Father Secchi made several interesting communications. The first was on shooting stars. The cholera had dispersed the small staff of assistants at his disposal at Rome; nevertheless, he had two observers who determined that on the 10th of November the hourly number was thirty-five between two and three in the morning. Comparing this number with that observed in the previous

year, it appears that at Rome the diminution was not so sensible as at other places. He then presented a stellar spectroscope, of very moderate dimensions, made by Secretan; also a memoir on the actual state of the science of meteorology as regards meteorographic instruments, and laid upon the table sheets on which the meteorograph of the Exhibition had traced curves.

M. Archiac presented several memoirs relative to geology.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, SEPT. 3, 1867.

Scientific Association at Cherbourg.—Electricity of Connecting Straps in Machinery.—The Triangulation of Prussia.

THE meetings of the Scientific Association at Cherbourg were terminated on the 24th of August. Nothing was neglected to increase the interest of this re-union of savants and amateurs. Visits were made to the soda and iodine works of M. Cournerie, to the military port, where the *Dunderberg*, now christened the *Rochambeau*, and where the spur of the *Atalante* is being cast; lectures were delivered on astronomy and meteorology, at which the professors attended, furnished with instruments, due to the munificence of the government; and there were also reports, memoirs, notices, and discussions on different points of the natural, physical, and moral sciences.

M. Quesnault, sub-prefect of Valognes, presented a memoir in which he demonstrated that the British Isles and the small archipelago existing on the north-west coasts of France, from the Cape la Hague to Cancale point, or rather, as far as St. Malo, formed part of the Continent, and laid down a map on which all the vestiges of terrestrial vegetation existing, or supposed to exist, under the sea were shown.

M. Lenoir, director of the telegraph at Saint-Lo, called the attention of the assembly to the electricity of connecting-straps in machinery, and the dangers which might result from it in powder works.

A fortuitous circumstance added considerably to the interest attached to this meeting. Lady Franklin, widow of the celebrated explorer of the northern regions, assisted at the meetings of the 23rd and 24th ult. The noble lady had arrived on the 22nd by the American frigate the *Minnesota*, accompanied by Miss Grennell, a young lady, the daughter of a shipowner of New York, who had fitted out at his expense two ships for the research of Sir John Franklin. At the last meeting it so happened that M. Lambert gave a description of his project of a voyage to the North Pole. This *rencontre* of Lady Franklin and M. Lambert is described as presenting a most impressive scene to the audience. Lady Franklin was to leave on the 27th on board the pleasure yacht *Leda*.

The first volume of the report on the triangulation of Prussia had scarcely been published when it was attacked on all sides. It comprised the triangles measured in the eastern portion of the kingdom. The first attack was made by Lieut.-General de Baeyer, the former collaborator of de Bessel, who repulsed with much vivacity a criticism made upon certain triangles of de Bessel, contained in the preface of the work in question; he showed, on the same occasion, that the results obtained were in all respects inferior to those of the ancient triangulation of de Bessel, and those of the triangulation of the coasts of Prussia. He stated that, in 1863, the Prussian Government had confided to M. de Baeyer the direction of the survey, and that at that period he had already disproved of many things in the work which had been submitted to him. The Ordnance department took no notice of his protestations, and published the work in question without even informing M. de Baeyer, who was much surprised to find all the faults pointed out by him, and as many others as they had time to add. He has

hastened to disavow this publication in a letter addressed to the *Astronomische Nachrichten*. Lieutenant-Colonel de Hesse, Chief of the Ordnance Department, replied, and undertakes to justify himself, but M. Peters has taken part himself against the department. Moreover, M. Wittstein, Professor of Mathematics at Hanover, has published two articles successively in the same journal, in which he endeavours to prove that the Department of Triangulation does not know what a personal error is, and that it does not know how to *compose* the bearings observed at the same station. M. Wittstein concludes that all the calculations of the triangulation must be made over again.

M. Pisko, professor of physics at the Lyceum of Wieden, at Vienna, has related to us a curious accident which he witnessed, and which is highly interesting to physiologists. The servant of the laboratory of the Lyceum is an old corporal of the *gendarmes*, of a strong constitution and always in excellent health. In the month of February last year he was occupied in cleaning an induction apparatus, and he conceived the idea of trying it with several elements. When he had laid hold of the two handles he could not let them go. Fearing that his imprudence should be discovered he would not cry out for help though he was groaning with pain. He remained in this situation for more than ten minutes, and we cannot tell what would have happened if he had not fallen to the ground and in his fall broken the conducting wire. After some time he recovered the use of his limbs and continued his usual occupation. The following day he felt some uncomfortable and strange symptoms; when walking he fancied that everything he walked upon was spherical. The next day, about 11 o'clock, these sensations became stronger, both his arms were swelled from the elbow to the fingers, and the legs from the knee to the extremity of the toes; the patient had to keep his bed. When he tried to get up it seemed as if he could not touch the ground, the swelling and the pain attaining its maximum about 2 o'clock and disappearing about 4 o'clock. A doctor was called, in but the man at first concealed the nature of his malady; he said he had stirred the acid of the battery with his hand. Warm baths ordered by the doctor produced no effect. It was only on the fifth day that M. Pisko, absent till then, was informed of the state of his assistant. M. Pisko went to see him, and on his saying that he did not believe the story of the acid, the man confessed what had happened. The Professor then proposed to the doctor who attended the patient to use the same remedy as that applied in cases of lightning stroke, viz., quinine and old wine. This treatment turned out to be efficacious, and by the end of fifteen days the periodical symptoms had gradually disappeared, without leaving a trace. Nevertheless, in the month of February last, just a year after the accident, the same symptoms were renewed, though with less intensity. Treated with the same remedy as before they yielded at the end of eight days. It will be curious to see if the symptoms return in February, 1868.

The Imperial School of Pharmacie has just lost one of its most experienced savants, in the person of M. Guibourt, honorary professor. He was born in Paris, in 1790, and was, at sixteen years old, on the termination of his classical studies, apprenticed to the Boudet pharmacy. He was author of several pharmaceutical works of the highest merit. By these and his constant studies he acquired, justly, the name of being the most distinguished savant in medical and pharmaceutical materia. Named Member of the Academy of Medicine in 1824, and Professor of the School of Pharmacy in 1832, he was also received into many national and foreign learned societies.

F. MOIGNO.

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BRITISH ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

DUNDEE MEETING, 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

DUNDEE, Sept. 12, 1867.

The meeting of the British Association, which has just terminated, must be regarded as most successful either from a scientific, financial, or social point of view. The actual number of members and associates at this meeting is 2,444 (this nearly equals the Aberdeen meeting (2,580) in the year 1859, when the Prince Consort was President); and the happy combination of science and relaxation which each day's programme has provided will cause the past week to be remembered with pleasure.

The attendance in the Sections was better than could have been anticipated, and the earnestness of the frequenters of Section B was shown, if not by the large attendance, at all events by the number of papers set down each morning to be read, and by the length and interest of the discussions which the more important of these papers elicited.

Every year the advantage of these autumnal meetings becomes more and more apparent. The value does not, however, arise from a diligent attendance at the Sections, but from those impalpable influences which result from a lounge in the reception-room—a picnic or excursion to some place of note in the neighbourhood—a look in at the B's, the Red Lions, or the Eastern Club. Men, who before only knew each other in the pages of a scientific journal, here meet in friendly companionship, and the keen scientific antagonist becomes a personal friend for life. A controversy which has been dragging on for years is settled by ten minutes' personal explanation; and opponents who were rapidly approaching the orthodox scientific intensity of hatred, carry away from such a meeting mutual forbearance and respect. These are precious results, and if the Sections are of no other use, they have the inestimable advantage of drawing men of kindred pursuits together from all parts of the kingdom, and giving them an excuse for a week's holiday under the convenient pretence of attending a scientific meeting.

The liberality extended to visitors by residents in the neighbourhood has been unbounded, every mansion having been full of guests. Lord Kinnaird has shown especial hospitality to the frequenters of Section B, and amongst the chemists staying at his seat—Rossie Priory—have been Dr. Angus Smith, Mr. Crookes, Mr. Spiller, and Mr. Ansell, the inventor of the fire-damp indicator.

Last week I mentioned that the reports of the Council and of the Parliamentary Committee had been presented to the Association. These contain some remarks which cannot fail to interest those readers of the CHEMICAL NEWS who are advocating the introduction of scientific education into schools. At the last meeting of the Association, the committee of recommendations referred to the Council certain resolutions which had been adopted by the committees of two sections relative to the teaching of natural science in schools. The Council, fully impressed with the importance of the subject, appointed a special committee for the purpose of enquiring into the question, and of preparing a report thereon. This committee consisted of the general officers of the association, the trustees, the Rev. F. W. Farrar, M.A., F.R.S., the Rev. T. N. Hutchinson, M.A., Professor Huxley, F.R.S., Mr. Payne, Professor Tyndall, F.R.S., and Mr. J. M. Wilson, M.A. The Council having considered the report presented by this committee, adopted the recommendations contained therein, and resolved that the report be submitted to the general committee at Dundee. These recommendations were given in our last number.

The Parliamentary Committee state that the attention of the public appears to have been awakened to the necessity for introducing scientific teaching into our schools, if we are not willing to sink into a condition of inferiority as regards both intellectual culture and skill in art, when compared with foreign nations. The voluntary efforts of the masters of two of our great schools to add instruction in natural science to the ordinary classical course are deserving of all praise; and some evidence of their success may be derived from the interesting fact—disclosed in the able report of the committee appointed by the Council of the Association to consider this subject—that some of the boys at Harrow have formed themselves into a voluntary association for the pursuit of science.

This has formed the subject of a special discussion in the Committee of Section B, who have recommended "that a committee be appointed to inquire into the present methods of teaching chemistry and physics in schools of various classes, and to suggest the best means of furthering it in accordance with the recommendations of the report."

I mentioned last week that a lecture was to be delivered on Thursday evening,

"On Matter and Force."

By Professor, TYNDALL, F.R.S.

This lecture was not addressed to members of the British Association, but to working men, of whom nearly 3,000 were present, the large Kinnaird Hall being crowded to suffocation. To give the lecture at length would occupy more pages than can be well spared. I cannot refrain, however, from quoting some extracts from one of the most eloquent addresses which this gifted orator has ever delivered. The subject matter of the lecture offered no special interest to those who are in the habit of listening to this philosopher in his home—the Royal Institution, but not a word or experiment was lost upon the auditors, who testified their admiration of the noble and high-toned sentiments by silent rapt attention, and of the brilliant experiments by enthusiastic applause, occasionally so prolonged that the lecturer was obliged to beg them to moderate their cheering, or he should be obliged to extend the hour and a half allotted to him to two hours. Professor Tyndall's language is always elevated in tone, and his speculations bold and fearless; and those who listened to the climax of tumultuous applause which followed his splendid peroration, looked in vain for any evidence of that intolerance of free-thought which is supposed to be a national characteristic north of the Tweed.

Professor TYNDALL commenced by remarking on the avidity with which the working men of London seized the opportunities afforded them by the evening lectures delivered every year by the Professors in the Royal School of Mines. It was a noteworthy fact that these lectures were but rarely of a character which could help the artisan in his daily pursuits. It was a pure desire for knowledge, as a thing good in itself, and without regard to its practical application which animated these men.

"They wish to know," he continued, "more of the wonderful universe around them; their minds hunger for this knowledge as naturally as their bodies hunger for food, and they come to us to satisfy this intellectual want. It is easily argued as a plea for science that it affords great material benefits. So it does. No doubt of it. Without science your Dundee would be a very small place indeed. But still the scientific discoverers—those high priests, so to say, of Science—they are, I assure you, in this work very rarely actuated by a desire for practical application at all. Take that great man whose name I can hardly trust my lips to utter—that man whom I loved—and who has lately gone from this earth—that man Faraday. That man—a poor book-binder's apprentice—has done more for practical science than dozens of your practical men added together; and he has done it without ever caring to gain a shilling by it. He did it because he loved science; and I say it behoves the Legislature to know that the real workers in science are not those who are always trying to turn it to a practical account. They love science for itself, and their desire is to understand and know all the phenomena of this glorious universe.

Whether it be a consequence of long-continued development, or whether it be an endowment conferred once for all on man at his creation, we find him here gifted with a mind, curious to know the cause of things, and surrounded by things which excite its questionings, and raise the desire for an explanation. It is related of a young Prince of one of the Pacific Islands, that when he first saw himself in a looking-glass, he ran round the glass to see who was standing at the back. He wished to know the cause of what he saw. And thus it is with the general human intellect when it regards and ponders the phenomena of the external world. It wishes to know the causes and connections of these phenomena. What is the sun, what is the earth, what should we see if we came to the edge of the earth and looked over? What is the meaning of thunder and lightning, of hail, rain, storm, and snow? Such questions early presented themselves to men, and by and by it was discovered that this desire for knowledge was not implanted in vain. After many trials it became evident that man possessed the power of solving such questions—that within certain limits the secret of the universe was open to the human understanding. It was found that the mind of man had the power of penetrating far beyond the boundaries of his five senses; that the things which are seen in the material world depend for their action upon things unseen; in short, that besides the phenomena which address the senses, there are laws and principles and processes which do not address the senses, but which must be, and can be, spiritually discerned.

Now, there are two things which form, so to say, the substance of all scientific thought. The entire play of the scientific intellect is confined to the combination and resolution of the ideas of matter and force. Newton, it is said, saw an apple fall. To the common mind this presented no difficulty and excited no question. Not so with Newton. He observed the fact; but one side of his great intellectual nature was left unsatisfied by the mere act of observation. He sought after the principle which ruled the fact. Whether this anecdote be true or not, it illustrates the fact that the ordinary operations of nature, which most people take for granted as perfectly plain and simple, are often those which most puzzle the scientific man. To the conception of the matter of the apple

Newton added that of the force that moved it. The falling of the apple was due to an attraction exerted mutually between the apple and the earth. He applied the idea of this force to suns and planets and moons, and showed that all their motions were necessary consequences of the action of this force of attraction. He proved that the planetary motions were what observation made them to be, because every particle of matter in the solar system attracts every other particle by a force which varies as the inverse square of the distance between the particles. He showed that the moon fell towards the earth, and that the planets fell towards the sun, through the operation of the same force that pulls an apple from its tree. And this all-pervading force, the conception of which was necessary to Newton's intellectual peace, is called the force of gravitation. All force may be ultimately reduced to a push or a pull in a straight line; but its manifestations are various, and sometimes so complex as entirely to disguise its elementary constituents.

Long thinking and experimenting on the materials which compose our world have led philosophers to conclude that matter is composed of atoms from which, whether separate or in combination, the whole material world is built up. The air we breathe, for example, is mainly a mixture of the atoms of two distinct substances, called oxygen and nitrogen. The water we drink is also composed of two distinct substances, called oxygen and hydrogen. But it differs from the air in this particular, that in water the oxygen and hydrogen are not *mechanically* mixed, but *chemically* combined. In fact, the atoms of oxygen and those of hydrogen exert enormous attractions on each other, so that when brought into sufficient proximity they rush together with an almost incredible force to form a chemical compound.

One consequence of the clashing together of the atoms is the development of a great amount of heat. What is this heat? How are we to figure it before our minds? I do not despair of being able to give you a tolerably distinct answer to this question. Here are two ivory balls suspended from the same point of support by two short strings. I draw them thus apart and then liberate them. They clash together, but, by virtue of their elasticity, they quickly recoil from each other, and a sharp vibratory rattle succeeds their collision. This experiment will enable you to figure to your mind a pair of clashing atoms. We have, in the first place, a motion of the one atom towards the other—a motion of translation, as it is usually called. But when the atoms come sufficiently near each other, elastic repulsion sets in, the motion of translation is stopped and converted into a motion of vibration. To this vibratory motion we give the name of heat. Thus, three things are to be kept before the mind—first, the atoms themselves; secondly, the force with which they attract each other; and thirdly, the motion consequent on the exercise of that force. This motion must be figured first as a motion of translation, and then as a motion of vibration; and it is not until the motion reaches the vibratory stage that we give it the name of heat. It is this motion imparted to the nerves that produces the sensation of heat.

It would be useless to attempt a more detailed description of this molecular motion. After the atoms have been thrown into this state of agitation, very complicated motions must ensue from their incessant collision. There must be a wild whirling about of the molecules. For some time after the act of combination, this motion is so violent as to prevent the molecules from coming together. The water is maintained for a time in a state of vapour; but as the vapour cools, or, in other words, loses its motion, the water molecules coalesce to form a liquid. And now we are approaching a new and wonderful display of force. No one who had only seen water in its vaporous or liquid form could imagine the existence of the forces to which I am now about to refer; for, as long as the sub-

stance remains in a liquid or vaporous condition, the play of these forces is masked by the agitation kept up by the heat among the molecules. But let the heat be gradually withdrawn, the antagonist to their union being removed, the molecules begin to form new combinations. Like the particles of iron in our magnetic experiment, the water molecules are endowed with attractive and repulsive poles, and they arrange themselves together in accordance with these attractions and repulsions. Solid crystals of water are thus formed, to which we give the familiar name of ice. To the eye of science, these ice crystals are as precious as the diamond—as purely formed, as delicately built. Where no disturbing causes intervene, there is no disorder in this crystalline architecture. By their own structural power molecules build themselves on to molecules with a precision infinitely greater than that attainable by the hands of man. We are apt to overlook the wonderful when it becomes common. Imagine the bricks and stones of this town of Dundee endowed with locomotive power. Imagine them attracting and repelling each other, and arranging themselves in consequence of these attractions and repulsions so as to form streets and houses and Kinaird Halls; would not that be wonderful? No less wonderful is the play of force by which the molecules of water build themselves into the sheets of crystal which roof your ponds and lakes every winter. To use the language of the American poet, Emerson, "the atoms march in tune," moving to the music of law, which thus renders the commonest substance in nature a miracle of beauty to the mental eye. It is the function of science, not as some think to divest this universe of its wonder and its mystery, but, as in the case here before us, to point out the wonder and the mystery of common things.

Over a plate of perfectly clean glass I pour a little water in which a crystal has been dissolved. A film of the solution clings to the glass; and now I wish to make this film crystallise before your eyes. By means of a microscope and electric lamp, I throw an image of the plate of glass upon the screen. The beam of the lamp, besides illuminating the glass, also heats it; evaporation is thereby promoted, and, at a certain moment, when the solution has become supersaturated, splendid branches of crystals shoot out over the screen. A dozen square feet of surface are now covered by those beautiful forms. Here we have crystalline spears shooting over the screen, feathered right and left by other spears. Molecule thus closes with molecule, until, finally, the whole subsides into crystalline rigidity. I move a new portion of the film into the beam. From distinct nuclei in the middle of the field of view the crystalline spears shoot with magical rapidity in all directions. For a moment the whole film appears to be alive, and now it has sunk into molecular repose. The film of water on a window pane on a frosty morning exhibits effects quite as wonderful as these. Latent in this formless solution, latent in every drop of water lies this marvellous structural power, which only requires the withdrawal of opposing forces to bring it into action. These experiments show that the common matter of our earth—"brute matter," as Dr. Young calls it—when its atoms and molecules are permitted to bring into free play the forces with which they are endowed, arranges itself under the operation of these forces, into forms which rival in beauty those of the vegetable world. And what is the vegetable world itself but the result of the complex play of these molecular forces? Here, as elsewhere throughout nature, if matter moves it is force that moves it, and if a certain structure is produced it is through the operation of the forces with which the atoms and molecules composing the structure are endowed. These atoms and molecules resemble little magnets with mutually attractive and mutually repellent poles. The attracting poles unite, the repellent poles retreat from each other, and vegetable forms are the final expression of this complicated play of molecular force. In the formation of our lead and silver trees, we needed an agent to wrest the lead and the silver

from the acids with which they were combined. A similar agent is required in the vegetable world. The solid matter of which our lead and silver trees were formed was, in the first instance, disguised in a transparent liquid; the solid matter of which our woods and forests are composed is also, for the most part, disguised in a transparent gas, which is mixed in small quantities with the air of our atmosphere. That gas is formed by the union of carbon and oxygen, and is called carbonic acid gas. Two atoms of oxygen and one of carbon unite to form the molecule of carbonic acid which, as I have said, is the material from which wood and vegetable tissues are mainly derived. The carbonic acid of the air being subjected to an action somewhat analogous to that of the electric current in the case of our lead and silver trees, has its carbon liberated and deposited as woody fibre. The watery vapour of the air is subjected to a similar action; its hydrogen is liberated from its oxygen, and lies down side by side with the carbon in the tissues of the tree. The oxygen in both cases is permitted to wander away into the atmosphere. But what is it which thus tears the carbon and the hydrogen from the strong embrace of the oxygen? What is it in nature that plays the part of the electric current in our experiments? The rays of the sun. The leaves of plants absorb both the carbonic acid and the aqueous vapour of the air; these leaves answer to the cells in which our experiments on decomposition by the electric current took place. In the leaves the solar rays decompose both the carbonic acid and the water, permitting the oxygen in both cases to escape into the air, and allowing the carbon and the hydrogen to follow the bent of their own forces. And just as the molecular attractions of the silver and the lead found expression in the production of those beautiful branching forms seen in our experiments, so do the molecular attractions of the liberated carbon and hydrogen find expression in the architecture of grasses, plants, and trees.

In the fall of a cataract or the rush of the wind we have an example of mechanical power. In the combinations of chemistry and in the formation of crystals and vegetables we have examples of molecular power. Before proceeding further I should like to make clear to you the present condition of the surface of the globe with reference to power generally. You have learned how the atoms of oxygen and hydrogen rush together to form water. I have not thought it necessary to dwell upon the mighty mechanical energy of their act of combination, but, in passing, I would say that the clashing together of 1 lb. of hydrogen and 8 lbs. of oxygen to form 9 lbs. of aqueous vapour, is greater than the clash of a weight of 1000 tons falling from a height of 20 feet against the earth. Now, in order that the atoms of oxygen and hydrogen should rise by their mutual attractions to the velocity corresponding to this enormous mechanical effect, a certain distance must exist between the particles. It is in rushing over this distance that the velocity is attained. This idea of distance between the attracting atoms is of the highest importance in our conception of the system of the world. For the world may be divided into two kinds of matter; or rather the matter of the world may be classified under two distinct heads—namely, of atoms and molecules which have already rushed together and thus satisfied their mutual attractions, and of atoms and molecules which have not yet rushed together, and whose mutual attractions are, therefore, as yet unsatisfied. Now, as regards motive power, the working of machinery, or the performance of mechanical work generally by means of the materials of the earth's crust, we are entirely dependent on those atoms and molecules whose attractions are as yet unsatisfied. Those attractions can produce motion, because sufficient distance intervenes between the attracting molecules, and it is this molecular motion that we utilise in our machines. Thus we can get power out of oxygen and hydrogen by the act of their union, but once they are

combined, and once the motion consequent on their combination has been expended, no further power can be got out of the mutual attraction of oxygen and hydrogen. Their mutual attractions are then satisfied, and as dynamic agents they are dead.

Now, if we examine the materials of which the earth's crust is composed, we find them to consist for the most part of substances whose atoms have already closed in chemical union—whose mutual attractions are satisfied. Granite, for instance, is a widely diffused substance; but granite consists, in great part, of silicon, oxygen, potassium, calcium, and aluminium, the atoms of which substances met long ago in chemical combination, and are therefore dead. Limestone is also a widely-diffused substance. It is composed of carbon, oxygen, and a metal called calcium. But the atoms of those substances closed long ago in chemical union, and are therefore dead. And in this way we might go over the whole of the materials of the earth's crust, and satisfy ourselves that though they were sources of power in ages past, and long before any being appeared on the surface of the earth capable of turning their power to account, they are sources of power no longer. And here we might halt for a moment to remark on that tendency so prevalent in the world, to regard everything as made for human use. Those who entertain this notion hold, I think, an overweening opinion of their own importance in the system of nature. Flowers bloomed before men saw them, and the quantity of power wasted before man could utilise it is all but infinite compared with what now remains to be applied. The healthy attitude of mind with reference to this subject is that of the poet, who, when asked whence came the rhododendron, replied—

"Why wert thou there, O rival of the rose?
I never thought to ask, I never knew,
But in my simple ignorance supposed
The self-same power that brought me there brought you."

A few exceptions to this general state of union of the particles of the earth's crust—all-important to us, but trivial in comparison to the total store of which they are but the residue—still remain. They constitute our main sources of motive power. By far the most important of these exceptions are our beds of coal, composed chiefly of carbon, which has not yet closed in chemical union with oxygen. Distance still intervenes between the atoms of carbon and those of oxygen, across which the atoms may be impelled by their mutual attractions; and we can do nothing more than utilise the motion produced by this attraction. Once the carbon and the oxygen have closed together, so as to form carbonic acid, their mutual attractions are satisfied; and while they continue in this condition, as dynamic agents they are dead. Our woods and forests are sources of mechanical energy, because they also have the power of uniting with the atmospheric oxygen, and the molecular motion produced in the act of union may be turned to mechanical account. And let it be remembered that the source of motive power here referred to, is also the source of muscular power. A horse can perform work, and so can a man; but this work is at bottom the molecular work of the elements of the food and the oxygen of the air. We inhale this vital gas. We bring it into sufficiently close proximity with the carbon and the hydrogen of the food. They unite in obedience to their mutual attractions, and their motion towards each other, properly turned to account by the wonderful mechanism of the body, becomes muscular motion.

One fundamental thought pervades all these statements: there is one tap-root from which they all spring. This tap-root is the ancient maxim that out of nothing nothing comes; that neither in the organic world nor in the inorganic is power produced without the expenditure of other power; that neither in the plant nor in the animal is there a creation of force or motion. Trees grow, and so do men and horses; and here we have new power incessantly introduced upon the earth. But its source, as I have already stated, is the sun. For he it is who sepa-

rates the carbon from the oxygen of the carbonic acid, and thus enables them to recombine. Whether they recombine in the furnace of the steam-engine or in the animal body, the origin of the power they produce is the same. In this sense we are all "souls of fire and children of the sun." But, as remarked by Helmholtz, we must be content to share our celestial pedigree with the meanest living thing. The frog, and the toad, and those terrible things, the monkey and the gorilla, draw their power from the same source as man.

Some estimable persons here present very possibly shrink from accepting these statements; they may be frightened by their apparent tendency towards what is called materialism—a word which to many minds expresses something very dreadful. But it ought to be known and avowed that the physical philosopher, as such, must be a pure materialist. His inquiries deal with matter and force, and with them alone. The action which he has to investigate is necessary action, not spontaneous action—the transformations, and not the creation, of matter and force. And whatever be the forms which matter and force may assume, whether in the organic world or the inorganic, whether in the coal beds and forests of the earth or in the brains and muscles of men, the physical philosopher will make good his claim to investigate them. It is perfectly vain to attempt to stop investigation as to the actual and possible combinations of matter and force. Depend upon it, if a chemist, by bringing the proper materials together, could produce a baby he would do it. And why not? There is no command forbidding him to do it—his inquiries in this direction are limited solely by his own capacity and the inexorable laws of matter and force. At the present moment there are, no doubt, persons experimenting on the possibilities of producing what we call life out of inorganic materials. Let them pursue their studies in peace; it is only by such trials that they will learn the limits of their powers.

But while I thus make the largest claim for freedom of investigation—while I as a man of science feel a natural pride in scientific achievement, while I regard science as the most powerful instrument of intellectual culture, as well as the most powerful ministrant to the material wants of men, if you ask me whether science has solved, or is likely to solve, the problem of this universe, I must shake my head in doubt. We have been talking of matter and force; but whence came matter, and whence came force? You remember the first Napoleon's question, when the *savans* who accompanied him to Egypt discussed in his presence the problem of the universe, and solved it to their apparent satisfaction. He looked aloft to the starry heavens, and said—"It is all very well, gentlemen, but who made all these?" That question still remains unanswered, and science makes no attempt to answer it. As far as I can see, there is no quality in the human intellect which is fit to be applied to the solution of the problem. It entirely transcends us.

The mind of man may be compared to a musical instrument with a certain range of notes, beyond which in both directions we have an infinitude of silence. The phenomena of matter and force lie within our intellectual range, and as far as they reach we will at all hazards push our enquiries. But behind, and above, and around all, the real mystery of this universe remains unsolved; and here the true philosopher will bow his head in humility, and admit that all he can do in this direction is no more than what is within the compass of an ordinary child. Fashion this mystery as you will, with that I have nothing to do. But be careful that your conception of the Builder of this universe is not an unworthy conception. Invest that conception with your grandest, and highest, and holiest thought, but be careful of pretending to know more about it than is given to man to know. Be careful, above all things, of professing to see in the phenomena of the material world the evidences of Divine pleasure or displeasure. Doubt this all ye who would deduce from the fall of the Tower of Siloam, the sin and wickedness of

those who were crushed by the fall! Doubt this all ye who pretend to see in cholera, cattle plague, and bad harvests, the evidence of Divine anger! Doubt this—but it requires some courage to say these things in Scotland—all ye who assert that the depreciation of railway scrip is a consequence of railway travelling on Sundays. You know nothing about it. To such I say in substance, what was said by one of the mightiest Scotchmen living or dead—Thomas Carlyle—to the followers of Dr. Pusey—

"The Builder of this universe was wise,
He formed all souls, all systems, planets, particles;
The plan he formed his worlds and Æons by,
Was—Heavens!—was thy small nine-and-thirty articles!"

I now resume my report of the proceedings.

SECTION B. CHEMICAL SCIENCE.

Friday, September 6th.

The following papers were read:—

"On the present use of Lichens as Dye Stuffs."

By LAUDER LINDSAY.

In the absence of the author this paper was read by Dr. Odling. He said—It had been expected that the aniline dyes—a product from the distillation of coal tar—discovered a few years ago, would supersede the lichenous dye stuffs previously in use, and that the latter would speedily disappear, in consequence of the breaking up of the Highlands by railways—and the improvement of the communication between Glasgow, Edinburgh, and the south. To him, however, it seemed that all such predictions were at least premature. He confessed that such was the eminence and experience of the authorities, that for a time he acquiesced in their conclusions, and took it for granted that they were well grounded; but in the course of his investigations for a work which he had in preparation on lichenology, he had found that there existed abundant evidence of the use of lichens in commercial manufactures on a large scale, as well as for domestic purposes. Dr. Lindsay then stated that from facts which he had learned at the Exhibition of 1862, from his investigations while on a tour through the Orkney and Shetland Islands, and parts of the Highlands, and from numerous writers whom he quoted, he had come to conclusions favouring the belief that lichens would not be superseded, at least for a long time to come. He then proceeded to give numerous details of the use of lichen dyes for commercial and domestic purposes, to remark on the unsatisfactory state of the nomenclature and classification of the lichens, and to advocate a uniform system.

"A Note on Messrs. Wanklyn, Chapman, and Smith's Method of Determining Nitrogenous Organic Matters in Water."

By DUGALD CAMPBELL, F.C.S.

At the last meeting of the Chemical Society, June 20th, Professor J. A. Wanklyn read an extract from a paper by himself, Mr. E. T. Chapman, and Mr. M. H. Smith, *"On Water Analysis, and the Determination of Organic Matter in Water,"* in which they proposed a mode of estimating the amount of nitrogenous matter contained in water, whether it exists as ammonia, or urea, or as albuminous matter; a report of this is given in the CHEMICAL NEWS of July 5, p. 7.

Having for a number of years worked specially on the estimation of nitrogen in solutions containing ammonia, urea, and albuminous matters, I was much struck with the results which were given by these gentlemen, and at the time when the paper was read I expressed my doubts as to the accuracy of their observations, my own having been so diametrically opposite; still, although nothing was said on the reading of the extract about the actions being different with *moderately strong* and *very dilute* solutions, yet after my remarks something was said by one of the gentlemen (Mr. Chapman) in the discussion about strong solutions requiring different treatment; and remembering that my experiments had all been made upon what might be termed moderately strong solutions, certainly not very dilute solutions, I was silent, as I thought this might possibly account, at least to some extent, for the great differences in our results; still I did not think this could wholly account for them.

Since then, however, I have made a number of experiments with very dilute solutions of both urea and albumen, the results of which in a great measure, if not entirely, confirm my views stated at the time, viz. that urea is not perfectly decomposed by distilling with sodic carbonate as described by these gentlemen, and likewise that I had invariably detected ammonia in the distillate from a solution of albuminous matter when it was distilled under similar circumstances.

As regards the first part of the process, which is the estimation of ammonia in the water, and which is in my opinion a very material one, but which appears to me to have been passed over by these gentlemen as a thing of very little importance, all we are told of it is that "when the quantity of ammonia present in the original water is large it is determined directly, unless the water is too much coloured." In all the experience which I have had in determining the amount of ammonia in water by Nessler's test, working on the usual scale, I have never been able to apply it with any degree of accuracy to the original water, but always had to distil the water with some alkali and test the distillate; and this I know is the general experience; and if urea is so readily broken up in the distillation of water, as it is said to be by these gentlemen, I should have thought that some means of distilling the water in order to obtain from it the ammonia, without decomposing the urea, should have been given, and that a process for estimating the ammonia, urea, and albuminous matters in water would scarcely be complete without it.

After the determination of the ammonia, the next operation, we are told, is to introduce a litre of the water "into a retort with two grammes of sodic carbonate, and rapidly distil, the distillate being collected in a flask containing 100 c.c. When this is filled the receiver is changed, and another 100 c.c. distilled off; this is repeated a third time, and it is now found that all the nitrogen present in the original water, in the form of urea, has passed over in the form of ammonia. The ammonia in the distillate is then determined by Nessler's test."

I may state that in Parliament, and generally throughout the kingdom, when reports are made upon the analysis of waters, the results are required to be given in grains, or parts of a grain, in a gallon of the water of 70,000 grains at 60° Fahrenheit, and they are thus much more readily understood by engineers and the public generally, who are interested in these matters, than when otherwise expressed. I have, therefore, in the following experiments thought it best to state that the waters operated upon contained so many parts of a grain of the substance being experimented upon per gallon, and also to use grains in making the solutions in other parts of the experiments; but I have retained the litre and cubic centimeter measures, as I wished to follow explicitly the experiment as it is given above, as to the quantity of water taken for distillation and the amount of each of the distillates, in case anything might be said of my not having done so.

The first experiments were made with a solution of urea equal to the $\frac{1}{100}$ th part of a grain of urea in a gallon of water, Prof. Wanklyn having given this as a quantity by which his process could be tried, and with which he said it would work satisfactorily, as it had been described in their paper. The following are the details and results:—

A litre of water was taken in which was dissolved an amount equal to 0.011 grain of urea containing the elements of 0.0062 grain of ammonia, and introduced into a retort capable of holding twice this quantity. 30.87 grains (two grammes) of sodic carbonate were then added, and the distillation was proceeded with rapidly, and the distillate collected exactly as described above. The ammonia which was found only in the two first 100 c.c., and estimated by Nessler's test, gave 0.0026 grains, or about one-third of the ammonia present in the urea taken.

There being no trace of ammonia in the third 100 c.c., I should from the statements of Messrs. Wanklyn, Chapman, and Smith, have concluded that all the urea was decomposed into ammonia, had I not known the quantity of urea which was taken at the outset, and also from my former experiments upon stronger solutions of urea which acted very similarly; but knowing this, a solution of potassic hydrate was introduced into the retort, and the distillation proceeded with exactly as before described; the two first 100 c.c. which were distilled over, contained 0.002 grains of ammonia, and the third distillate containing no ammonia; potassic permanganate was added in crystals to the liquid in the retort until it was deeply coloured, and the distillation was again proceeded with as above; the remainder of the ammonia, which was estimated at 0.0015 grain, was in the first and second, but principally in the first 100 c.c., and none in the third. Altogether the ammonia obtained was 0.0061 grain, the calculated quantity being 0.0062 grain.

This experiment was repeated as above described, but with somewhat different results, the distillations with the sodic carbonate giving 0.0021 grain, the potassic hydrate 0.0016 grain, and the potassic permanganate 0.0025 grain, altogether 0.0062 grain of ammonia, which is exactly the quantity of ammonia in the urea taken.

Experiments were next made with a solution of urea equal to $\frac{1}{100}$ th part of a grain of urea in a gallon of water, and the following are the details and results:—

A litre of water was taken in which was dissolved a quantity equal to 0.0055 grain of urea, containing the elements of 0.0031 grain of ammonia, and distilled as above with sodic carbonate; in the first two 100 c.c. the ammonia present amounted to 0.001 grain; in the third 100 c.c. there was no ammonia; potassic hydrate gave in the first two 100 c.c. 0.001 grain of ammonia, in the third none, and potassic permanganate gave in the first two 100 c.c., but principally in the first, 0.0011 grain of ammonia, making altogether 0.0031 grain of ammonia, which is the exact quantity of ammonia in the urea taken.

This experiment was repeated exactly as above, but, as in the former case, with slightly different results; sodic carbonate gave 0.001 grain, potassic hydrate gave 0.0001 grain, and potassic permanganate 0.002 grain ammonia, making altogether 0.0031 grain of ammonia.

Experiments were next made with a solution of urea equal to $\frac{1}{100}$ th part of a grain of urea in a gallon of water, and the following are the details and results:—

A litre of water was taken, in which was dissolved an amount equal to 0.0025 grain of urea, containing 0.00155 grain of ammonia, and treated in the same manner as in the preceding experiments; with sodic carbonate it gave 0.0013 grain ammonia in the first two 100 c.c., and no ammonia in the third; with potassic hydrate 0.0001 grain in the first two 100 c.c., and none in the third; and with potassic permanganate, gave 0.0001 grain of ammonia;

altogether within a fraction of the amount of ammonia in the urea employed.

This experiment was repeated, and the results were as follows:—With sodic carbonate, 0.0008 grain, with potassic hydrate 0.0003 grain, and with potassic permanganate 0.0004 grain; altogether 0.0015 grain of ammonia, and making the same amount of ammonia as the last, but evolved differently.

Experiments were next made with a solution of urea equal to the 100th part of a grain of urea in a gallon of water, and the following are the details and results:—

A litre of water was taken in which were dissolved 0.0022 grain of urea containing 0.00136 grain of ammonia, and distilled as above; with sodic carbonate in the first two 100 c.c. there were 0.001 grain of ammonia, and no ammonia in the third 100 c.c.; and by potassic hydrate in the first two 100 c.c. 0.0003 grain; whilst by potassic permanganate there was no ammonia. The ammonia distilled off was altogether 0.0013 grain, which is a fraction less ammonia than was contained in the urea employed.

This experiment was repeated with a nearly similar result.

Experiments were next made with a solution of urea equal to the $\frac{1}{100}$ th part of a grain of urea in a gallon of water, and likewise with still smaller portions of urea, when it was found in all cases that with sodic carbonate all the ammonia contained in the urea distilled over in the first 100 c.c.

From these experiments it would appear that urea is decomposed entirely when distilled in the ordinary manner with sodic carbonate, but only when in extremely dilute solutions; requiring the assistance of potassic permanganate to decompose it even when so dilute as in the proportion of the $\frac{1}{100}$ th part of a grain of urea in a gallon of water, or one part in five millions; and requiring the assistance of potassic hydrate to decompose it even when diluted to an extent above one part in seven millions; and that is only decomposed by sodic carbonate alone when distilled somewhat above this point.

I may add that these and all other experiments were made with distilled water, which tried in every way showed not a trace of ammonia by Nessler's test, and that every experiment was made by dissolving at the time fresh crystals of urea; or, in other words, that no solution of urea was employed which had been made or kept any time. I may also add that I found a considerable difference in the various specimens of urea which I examined; all gave distinct indications of ammonia by the Nessler test; the larger, less coloured, and finer the crystals the more was the ammonia. I need scarcely add that working upon such very dilute solutions as I was doing, the latter specimens yielded sensibly more ammonia by the sodic carbonate and potassic hydrate than those showing less indications of ammonia by the Nessler test; still I do not doubt that working with any ordinary urea, the results will not be far different from my own, although variable.

The next part of the process to which I wish to call attention is the estimation of what is termed the "albuminous substances."

According to Messrs. Wanklyn, Chapman, and Smith, albumen, such as from white of egg, yields no ammonia, ascertained by Nessler's test, when a solution of albumen is distilled with the proportions of sodic carbonate, 30.87 grains (2 grammes), which they say they use to decompose the urea; whereas, as I stated before, in all my experiments I had invariably found that ammonia was evolved under such circumstances. I may observe that hitherto my experiments had been made upon what might be termed rather strong solutions (one grain of dry albumen in a gallon of water), and hence I was led to make the following experiments with what I conceive to be weak solutions:—

The first experiment was made with a quantity about equal to the $\frac{1}{100}$ th part of a grain of dry albumen to 1 gallon of water.

100 grains of the white of new-laid eggs, dried, gave 12.00 grains of dry residue containing 1.884 grains of ammonia; or 100 grains of such white of egg contained 1.884 grains of ammonia.

A litre of water was taken in which was dissolved an amount equal to 0.093 grain of white of egg containing 0.00175 grain of ammonia, and was distilled with 30.87 grains (2 grammes) of sodic carbonate; in the two first 100 c.c. of the distillate 0.0006 grain of ammonia were estimated by Nessler's test, in the third 100 c.c. there was not a trace of ammonia; potassic hydrate was then added, and the distillation was gone on with as before, when not a trace of ammonia was discovered in any of the three 100 c.c. distilled; potassic permanganate was then added, and the distillation proceeded with, when it gave, principally in the first distillate, 0.001 grain of ammonia. Altogether there was a loss of 0.00015 grain of ammonia in the albumen.

This experiment was repeated with somewhat similar results, only rather more ammonia was evolved by the sodic carbonate, and again none by the potassic hydrate, and the remainder by the potassic permanganate.

The next experiment was made with about $\frac{1}{10}$ th part of a grain of dry albumen to a gallon of water, as follows:—

A litre of water was taken, in which was dissolved an amount equal to 0.0466 grain of white of egg, containing 0.00087 grain of ammonia, and distilled with the sodic carbonate. The two first contained 0.0007 grain of the ammonia; potassic hydrate gave no ammonia in any of the three 100 c.c., and potassic permanganate gave 0.0001, which is a loss of 0.00007 of a grain of the ammonia contained in the white of egg employed.

Another experiment was made with a quantity equal to the $\frac{1}{10}$ th part of a grain of dry albumen to a gallon of water, as follows:—

A litre of water was taken in which was dissolved an amount equal to 0.0233 grain of white of egg, containing 0.000435 grain of ammonia, and distilled with the sodic carbonate, the first two 100 c.c. gave 0.0002 grain of ammonia. By the potassic hydrate no ammonia was given off, and by the potassic permanganate 0.0002 grain, showing altogether a loss of ammonia equal to 0.000035 grain.

Another experiment was made with a quantity about equal to the $\frac{1}{10}$ th part of a grain of dry albumen to a gallon of water, as follows:—

A litre of water was taken in which was dissolved 0.01165 grain of white of egg, containing 0.000217 grain of ammonia, and distilled with the sodic carbonate. In the first two 100 c.c. of the distillate all the ammonia was evolved, in the third 100 c.c. there was none, nor when distilled with potassic hydrate or potassic permanganate was there a trace to be found.

This experiment was repeated and with the same results, all the ammonia being evolved in the first two 100 c.c. when the solution was distilled with sodic carbonate alone.

In all these experiments it will be seen that with the sodic carbonate a distinct quantity of ammonia is evolved, and likewise that in all these experiments, strange though it may appear, after the ammonia has been evolved as far as is possible by the sodic carbonate, that potassic hydrate evolves not even a trace, and it is only on the addition of potassic permanganate that the final quantity of nitrogen is expelled as ammonia. It will likewise be seen that, as in very dilute solutions of urea, all the nitrogen is expelled as ammonia by the sodic carbonate, so likewise this is the case in very dilute solutions of albumen.

The whole of the above experiments, both with the urea and the albumen, were conducted in ordinary retorts of not less than twice the capacity of the liquid to be distilled, and as nearly all alike in shape and size as it was possible to get them, and every endeavour was made to distil the solutions at a rapid speed and as nearly under

the same circumstances as possible, otherwise I do not think the results obtained would have been so regular as they are, but as far as I can judge from other experiments quite the reverse; still on the whole they would be generally confirmatory of the results I have obtained.

Since making these experiments, my attention has been directed to a paper by Mr. Chapman, "on Nessler's test for Ammonia," wherein that gentleman says that in comparing a solution to be tested with the ammonia standard, after adding the test he allows the liquids to stand for ten minutes before he compares them. My own experience, and I know it is that of others, is that this time is not nearly sufficient to develop the colour properly, and this is especially the case with very dilute solutions of ammonia; that being so I do not see why such solutions should not be allowed to stand until the colour is fully developed in them, although it make take a longer time, in which case experience has taught us that the results are a deeper and more defined colour, which admits of better, I might almost say, of perfect comparison. In carrying out the above experiments sufficient time was invariably allowed for the proper development of the colour when determining the amount of ammonia in all of the distillates.

"A Description of a New Ether Anemometer."

By ALFRED E. FLETCHER.

Government Inspector of Alkali Works for the Western District.

The construction of this apparatus is based on the fact that a current of air passing across the open end of a straight tube causes a partial vacuum in it.

An application of this principle is seen in a small toy in common use, in which a liquid is made to ascend several inches in a vertical tube, by blowing through another tube across its open end. It rises by virtue of the partial vacuum caused by the current of air which crosses it.

If then a straight tube is inserted through a hole in the brickwork of a chimney or flue, so that the current of air in the flue passes across its open end, a partial vacuum will be formed in it, greater or less in proportion to the velocity of the current.

A tube in such a position will, however, communicate a suction arising from that of the chimney itself, besides that suction produced by the current of air passing across its open end, and for the present purpose these two must be distinguished.

To effect this two tubes should be inserted in the chimney, one of them having a straight and the other a bent end, the bend to be turned so as to meet the current of air; both tubes are open. In each of these tubes will be experienced the partial vacuum due to the suction of the chimney itself. In the straight tube, however, this will be increased by the suction caused by the passage of the current of air across its open end, while in the case of the bent tube this will be diminished by the pressure caused by the current of air blowing into it. The difference therefore between the suction in the two tubes will be due to the action of the current of air in the chimney, and it remains only to measure this difference in order to measure the velocity of the current itself.

To effect this let these tubes be connected with a U tube containing water, one with each limb; then the water will be raised up in one limb to a degree corresponding with the difference of suction, so that the difference of level of the water in the U tube, being a measure of the difference of suction in the tubes, becomes a measure of the velocity of the current of air in the chimney. By this arrangement the suction power of the chimney itself is eliminated, for it operates equally on each limb of the U tube, while the difference of pressure

experienced will be due only to the different action of the current of air in the flue on the tube with the straight end and the one with the bent end.

It remains, then, to register accurately this difference of level of the water in the U tube, and to construct a formula connecting it with the speed of the current of air in the flue, so that by measuring the one the other may be measured also.

Experiment showed that for high speeds of air the measurement of the difference of this water level was easy, but that for speeds below 5 feet per second the amount became too minute and uncertain for practical use.

Many plans were then devised for constructing a pressure gauge which should be more delicate than the ordinary U tube.

Efforts were first made to modify the U tube so that its range might be increased and its indications magnified. This might be done by drawing out its lower bend horizontally and increasing the size of the vertical portions till it assumed the form of two vertical cylinders connected by a long horizontal tube. If now a pressure were exerted which would cause a depression of the water in one limb, the motion so caused in the narrow column of water in the horizontal tube would be so much greater, as its sectional area was smaller, than that of the vertical tubes. It was found, however, that in proportion as a greater range in the scale of the instrument was thus obtained, a greater amount of friction must also be encountered, and that thus the advantage of the one was neutralised by the evil of the other.

It is necessary to see this clearly in order to arrive at the conclusion that *all* methods of increasing the actual motion of the fluids or of magnifying it by any mechanical arrangement of levers or otherwise, must be open to the same objection. This proposition seems clear now, in the light shed by a long series of failures encountered in the attempt to act contrary to it, but it was not clear before.

The simple U tube was therefore returned to, and means adopted for accurately seeing and measuring its slightest indications. In the first place, the limbs were increased until they were no longer small tubes of about 0.4 inch internal diameter, but cylinders of 4 inches diameter; these were connected at the bottom by a small tube. Thus the power exerted by the pressure communicated through the connecting tubes, operating on the extended surface of the liquid in the cylinders, was increased a hundredfold over that operating in the smaller U tube; but the friction could only have been increased tenfold, giving therefore a tenfold increase of delicacy. In order to observe accurately the rise and fall of the liquid in the cylinders floats were introduced, on each of which was engraved a very fine horizontal line; and to measure accurately the comparative elevation or depression of these two lines, a finely divided scale and vernier were added, working with a delicate screw adjustment. With this it is possible to measure an elevation or depression of $\frac{1}{1000}$ inch, which is sufficiently accurate for the purpose in view.

On trying now to apply the instrument so constructed, and attempting to measure very minute variations of pressure, failure still seemed imminent; for although the motion of the water in the increased limbs of the U tube could be measured to $\frac{1}{1000}$ inch, the water refused to move, except under pressures exceeding that which would be indicated by so small a column; in other words, the water seemed to stick in the cylinders. It was necessary, therefore, to make experiments with various liquids in order to choose one more suitable than water; for this purpose a very thin plate of metal was suspended from the beam of a delicate balance, and the amount of power required for its immersion in, and subsequent withdrawal from, various liquids thus measured. This resistance is due to what is often called capillary attraction and repulsion; it is shown to exist largely in water, by the

fact that a needle may be made to rest on its surface without sinking. In the case of water 20 grains were needed to overcome it, while with many other liquids a much less force sufficed, and in the case of ether $\frac{1}{100}$ grain was sufficient. Ether was, therefore, chosen as the liquid which offered the least resistance, and also on account of its low specific gravity.

After substituting ether for water, the action of the manometer was quite satisfactory, the lines on the floats always return exactly to their original position after any disturbance, and its indications could be relied on to $\frac{1}{1000}$ inch.

It remained now to ascertain the value of these indications when applied to the measurement of the velocity of air.

Calculation might lead to this, but it was thought much better to depend, if possible, on actual experiment, and by testing the instrument with currents of air of known velocity to draw up a table for future use.

The following plan was adopted and found perfectly successful:—

A flue 14 inches diameter, 100 feet long, was constructed of iron pipes, one end was connected with the base of a high chimney, the other left open. A sliding plate of metal, capable of cutting off the connection between the chimney and the flue, served to regulate at will the amount of air drawn through it. At the open end of the flue a red-hot brick was placed, and on it was thrown at stated times a few drops of sulphuric acid. This raised instantly a dense cloud of white vapour, which, passing along the flue, could be observed to reach the other end, by looking through two holes bored through opposite sides of it. It remained now only to note the time occupied by the passage of the cloud of vapour along the flue to know the speed at which the air was passing through it. At the same time the tubes in connection with the ether manometer were in the flue and under the influence of the same current of air, so that the simultaneous reading of the instrument could be taken. By now altering the position of the slide which regulated the admission of air to the flue, the speed from time to time was altered, and a corresponding observation by the manometer obtained.

By the aid of this ether manometer the speed of any current of air in flues or chimneys can be measured by simply boring a hole one inch diameter through the brickwork and inserting two tubes, one with a bent, the other with a plain straight end as already described, and making the necessary observation of the floats; and in this operation neither soot, heat, nor corrosive vapours can prove any hindrance.

So sensitive is the apparatus that on a windy day the effect of each successive gust of wind is observable, as it causes variations in the draught of the chimney.

The instrument may be used as a wind gauge by fixing through the roof of an observatory a small vertical pipe, presenting a plain open end to the wind. The lower end of this pipe brought down into the observatory and connected with the ether manometer would communicate the varying pressures due to the varying speed of the wind.

"On an Apparatus for Indicating the Presence and Amount of Fire-damp in Mines."

By GEORGE F. ANSELL.

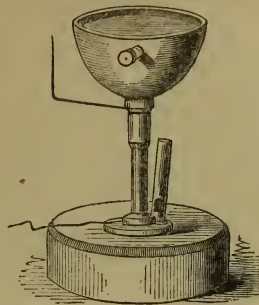
The idea embodied in the apparatus was founded on the law of diffusion announced by Mr. Graham, that gases diffuse in the inverse proportion to the square root of their densities, or, more popularly, that light gases diffuse more rapidly than heavy ones. Mr. Ansell showed, by experiment, that when a tube closed at one end by plaster of Paris was filled with common coal gas, the lighter part of the compound was rapidly diffused through the plaster, as

was at once seen by the yellow flame and slight explosion which ensued on bringing a lighted match close to the closed end. Hence, Mr. Ansell said, his proposition. In a pit the case is the reverse of that of the tube. There the gas is ready to escape into the galleries, and the apparatus must therefore be modified to suit the varying circumstances. The essential parts of the apparatus may be described as consisting of an alarm bell and a telegraph needle—the former being rung and the latter deflected by an electric current, which was set in motion by the action of the dangerous gas. The means by which this was effected consisted of an iron cup, on which was fixed a disc of white Sicilian marble, standing on a U-tube, which contained a quantity of mercury. The marble here represented the plaster which closed the end of the tube in the first experiment, and through it the dangerous gas was diffused. As it did so, the mercury was pressed up into the other extremity of the tube, completed the previously broken circuit, and an alarm was given by the ringing of the bell and the deflection of the needle.

Mr. Ansell proceeded to say that in coal-fields there are many casualties—including the bulk of the accidents arising from explosion,—caused by a sudden irruption of fire-damp (carburetted hydrogen), to such an extent as to render the atmosphere in even a mile of space explosive in a few minutes, and there are cases on record where an enormous space has been so polluted in a few seconds; but the common event is to find that a fall of roof, or the breaking in of a thin part of the sides or floor of a gallery, liberates an amount of gas which by mixture with the ordinary air of the pit renders the whole explosive. This mixture travels on slowly with the ventilation till it meets a light, and possibly an hour after its first formation destroys many lives. A source of great danger is that state of the pit which arises from the gradual bleeding of gas from coal. As one walks in a pit, one hears a continual "click," somewhat like the noise of a cricket. In some pits this may arise from the settling down of the strata and cracking of the coal, but the experienced ear soon knows the difference. Should any obstruction arise to the ventilation this bleeding very gradually raises the atmosphere from zero (the point of purity) to the point of explosion, or it may be that a gradual fall of the barometric pressure admits of the oozing out of gas either from a goaf, or from the mass of coal, and this, although minute, may be to such an extent as to render explosive the whole air of the pit if the ventilation be not very good. There are parts of a pit where gas may be so accumulated in half-an-hour, others where it may be two hours, and again others a whole day in rising to a dangerous mixture.

It is not uncommon thing to find thirty per cent of gas next the roof, at six inches below twenty per cent, and at fifteen inches no gas at all. I propose to fix the instruments* side by side, one for *sudden* and the other for *slow* accumulations, in pigeon-holes cast in iron posts, such as are used to support the roof, and to be used in addition to the ordinary supports for no other purpose than to carry the indicators, the pigeon-holes being clear all through, so that the gas can surround or sweep over the instruments while they are thus perfectly protected from falling substances; for the gas as it occurs in the pits is very curious in its habits, and from causes too minute to enumerate here, it "goes away" from a spot with very little disturbance. The pigeon-holes being formed in iron posts would protect the instruments from falling roof, &c., while grooves may be cast in the sides of these posts for the telegraph wires. It has been objected to by some that these instruments would cause greater destruction of life than now obtains, but these persons forget that my instruments are not intended to displace other means of safeguard. They are simply proposed as additional means of knowledge.

For the indication of carbonic acid I make a necessary alteration, which will be seen in the figure:—



This hardly needs description, for it will be seen at a glance that the current is completed by the rising of the mercury to the wire within the precincts of the closed chamber, formed by the neck of the funnel, and is adjusted for use by turning the base on which it stands, when a cork rises against a leather bag and presses the mercury up to the required height. Whether marble will stand for a long period in contact with carbonic acid, and without disintegration, has to be determined; if not, I can replace it by another septum. This instrument is proposed for use in those mines where carbonic acid becomes a dangerous substance for the miner. It has been sought by the French vine growers as a means of telling the time of the commencement of fermentation, and it seems probable that the English brewers will use it for a similar purpose.

In the event of fire-damp being known to exist, either when found by the fixed indicators or by the safety lamps, I propose for the use of the miner, the manager, or his deputy, an aneroid indicator, which is not intended for the *detection of gas in the pit*. The intention of this particular instrument is that it shall be used to determine the amount per cent of fire-damp or carbonic acid where they are known or suspected to exist; and for these purposes it must be used in rigid accordance with the instructions given with it, not according to the fancy of the user, or as *he thinks it should be used*.

It must be mentioned that the same amount per cent of fire-damp in different mines requires a varying time for diffusion through the same tile. The cause of this is not known, but it is under investigation. This variation is from 45 to 60 seconds; but in the same pit it is invariably of a uniform time, so that, once determined, there is no trouble. That this is a property of the gas, is proved by the fact that 10 per cent of gas in one pit will explode violently, while 10 per cent in another explodes with much less violence. The underwriters call one a sharp gas and the other a slow gas, and the appearance is perfectly well marked if observed for a few times in the Davy lamp.

A mine, to be well ventilated, should be so supplied with air that a considerable eruption should be detected below the point of explosion. Ventilation which is only sufficient for ordinary occasions must be considered entirely insufficient. The Act of Parliament at present in force specifies that the working places shall be so ventilated as that "under ordinary circumstances" they shall be "in a fit state for working passing therein." This clause of the Act should be altered, and the Act should specify that five per cent of fire-damp should be the maximum ever permitted to attain, because seven and a half per cent is the minimum explosion point, and five is two-thirds of seven and a half, which is surely as near as could be allowed with safety.

It has been objected that my instruments are too delicate for use in the pits—that, in fact, they demonstrate the existence of so small an amount of gas as to

* These instruments were fully described in the CHEMICAL NEWS, vol. xv., p. 13.

render their adoption a probable source of trouble by "showing the presence of $1\frac{1}{2}$ per cent of fire-damp, and thus causing alarm, while that amount is actually harmless." To this objection I would reply that I have made my instruments so delicate, because in their former state it was objected that they would not show *small quantities*—that is smaller quantities than could be detected by the safety lamps now in use. But this objection has no weight, because the instruments, although capable of being so delicately set, need not be so adjusted unless by the will of the responsible person. I prefer that they should be so adjusted as to give warning only when the quantity of gas present reaches the limit of the minimum explosion point; still I would urge that the fact of an instrument showing small quantities as well as large does not necessarily render it valueless.

When I was permitted to exhibit and explain my instruments in committee-room D of the House of Lords, Mr. J. M. Day inspected them, and in behalf of the Mining Association of Great Britain, he made to me the following proposition:—"That I should make experiments in the coal pits he would select, and if my instruments would effect what I said they would do, they would prove to be very valuable and would be adopted—if, on the other hand, they failed in such trials there would be an end of the matter."

In accordance with this suggestion I visited such pits as Mr. Day appointed, and which he purposely selected, that I might meet every variety of circumstance. My experiments were admitted to be successful. I have just (between 26th August and 1st September) completed an exhaustive series of experiments in the Monkland pits at Airdrie, and Mr. Murray gives me permission to say that he has satisfied himself that my indicator is practicable and reliable.

From facts within my own knowledge, I have reason to believe that one of the reasons why my instruments are not adopted is, that the colliers would not go down the pits or remain at work if it were demonstrated to them that there was a dangerous accumulation of fire-damp. That the men have fear of fire-damp is demonstrated by the fact that the bench of magistrates of Wednesbury did, on the 2nd November, 1866, convict and sentence to fourteen days' imprisonment three colliers for refusing to work in a coal mine because the said mine was full of fire-damp. Yet the owners took no measures to prove to the men the absence—thus admitting the presence of fire-damp, but contented themselves with the statement that the complaint of the men, although supported by witnesses, was an excuse for a holiday. I am of opinion that coal-owners and their agents will not voluntarily adopt any new proposition, they having for years blindly ignored the Davy lamp, and they still refuse in a very great measure to adopt safety-cages, safety-hooks to prevent overwinding, and the necessary number of ventilating shafts, abiding only just inside the law of the land.

I wish to remark that the state of the barometer *does not* give warning of the irruption of fire-damp till some hours after it has taken place; and in such cases mining engineers admit that an instrument would be of real service.

While the French have offered considerable prizes for the invention of means devised for the saving of *life* in mines, English mine owners have contented themselves with offering prizes for coal cutting machines devised only for the saving of *labour*, but I humbly submit that if I am right in my supposition that my instruments are calculated to save life, they ought to be adopted, and all I ask is that they should be fairly tried. I am permitted to refer enquires to Mr. F. Murray, Monkland House, Airdrie, who has some of these instruments in his pits, and who will kindly exhibit them in action.

In consequence of a wish expressed by Francis Murray Esq., Monkland House, Airdrie, I sent him some instruments that he in my absence might form an opinion as to the practical value of my indicators, and that the colliery people, workmen as well as officers,

might find out any objections to the instruments. Mr. Murray, in a note to me, says:—"the instrument was carried into the suspected places and put on the top of a post close to the roof of the working, in less than a minute after the connection was made the bell rang, the aneroid, (a pocket indicator) at the same spot indicating 45 per cent of gas. . . . I allowed the bell to ring for about a minute and then screwed up the screw until it ceased to touch the mercury, in less than a minute the alarm sounded again; I screwed up again with the same results until the screw would go no further. Mr. Murray then placed the instrument "on the floor where the aneroid indicated no fire-damp . . . re-adjusted the mercury, and repeated the above experiments with the same results."

"I then by means of the aneroid ascertained the height at which $7\frac{1}{2}$ per cent of gas was present, and then the alarm sounded in about five minutes. I then got all the gas driven out of the place, the aneroid indicating nothing at any height, and fixed the syphon at the height which formerly contained $7\frac{1}{2}$ per cent of gas. In one hour the alarm bell sounded. One turn of the screw was given and the alarm sounded again in ten minutes. The aneroid at the moment of the second alarm indicated 8 per cent of gas. These experiments were made with a new instrument covered with $\frac{1}{2}$ inch marble, and an old instrument the thickness of marble I do not recollect." This was an old instrument which had been in use a year in some pits and is covered with $\frac{1}{2}$ inch marble.

On Tuesday August 27, I went into the pits with Mr. Murray and some of his people, experimenting till 11.30 p.m. without a single failure. Quite the last thing, we chased the pit of gas and set four syphon instruments with a view to see if when gas accumulated slowly in the night the instruments would give warning and maintain their action till the morning. These instruments were visited in the morning by Mr. Crum and the fireman of the pit. Mr. Crum writes to me as follows:—"The place in the pit was filled with fire-damp till past the battery and the bell. The bell rung with $1\frac{1}{4}$ inch of zinc above top. All observations in the dark—no light even in main road—no Davy lamp."

Mr. Murray was present at part of these experiments, and the fireman, accompanied by a collier, was present at the whole of them reading the barometer indicator with me. Mr. Murray says, "There is no doubt from these experiments, which extended over a fortnight, that the instruments are quite reliable and quite easily managed. We worked under great disadvantages, the place was very low, I think the men said three feet four inches; but there is no difficulty in obtaining the results needed."

Professor ANDERSON believed that this was the first attempt to apply the law of diffusion to practical purposes, and it was certainly an invention of the highest importance. The only drawback to the instrument was that its nicety required it to be worked, not by ordinary colliers, but by intelligent men.

Mr J. L. BELL, of Newcastle, feared that the very nature of the work of a colliery, which would necessitate the perpetual movement of the apparatus, might impede its use by the workmen; but thought that, in the hands of the coal viewers, it might be turned to good account, as the accidents most feared by coal owners were those in which the atmosphere of a whole gallery, or a portion of one, was polluted. The instrument would be likely to be of immense value in the prevention of that wholesale destruction of life we had so often to lament. He was afraid, however, that familiarity would breed contempt, and that after the novelty of the invention had passed away, the men would be apt to neglect it.

Mr. ANSELL, in reply, stated that Mr. Murray's ordinary working colliers had used the instrument with perfect success. Mr. Murray had suggested that the whole apparatus should be enclosed. When this was done the workmen could in no way misuse it.

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BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

SECTION B. CHEMICAL SCIENCE.

"Notes of Analyses of Gold Coins of Columbia, New Grenada, Chili, and Bolivia; with some Account of the Operations of Gold Mining in Nova Scotia, Dominion of Canada."

By GEORGE LAWSON, Ph.D., LL.D.,

Professor of Chemistry, Dalhousie College, Halifax, N.S.

THE first part of this paper was principally devoted to the history and description of the gold coinage of the above-mentioned countries, with physical and chemical analyses. Some information was then given respecting the composition of the native gold of coining countries, and a useful list was appended, showing the principal gold coins of various countries, with their weights, fineness, and values, and a synopsis of the results of assays and analyses of native gold from the chief mines of the world.

The author then proceeds in the following words:—"Writing from a gold country, it may not be out of place if I refer briefly to the results of gold mining in this province. The geological relations of our auriferous quartz veins, so far as ascertained, have been detailed by several able geologists. I shall, therefore, merely offer a few statistics, serving to show the extent and present condition of the mines, which, although they have not proved so profitable as was anticipated by speculators, are still vigorously worked in most of the districts."

The general results of the gold mining operations in Nova Scotia up to the end of last year (1866) are shown in a table, the facts in which may be thus summarised:—"Total amount of quartz, &c., crushed, 101,946 tons; gold obtained, 91,958 ounces, nearly three tons weight, worth £380,861; giving an average of $2\frac{1}{2}$ grains of gold for every 100 lbs. weight of quartz crushed, and an average annual yield of gold of 20 oz. for every man employed, or a daily return of 6s. 10d. per man for every working day. This return has to meet, not only the wages of men, but likewise interest on capital, royalty, tools, machinery, and expenses of management.

"The gold of all the Nova Scotia mines compares very favourably with that obtained in other countries; in other words, our gold is remarkably pure. Whilst Californian gold, as shown by thousands of assays, contains on an average $11\frac{1}{2}$ per cent of silver, and the gold of several of the South American States a much larger proportion, our Nova Scotia gold contains (on an average of analyses) less than 4 per cent, and some samples less than 2 per cent of silver. The gold would be still purer were it not that the various metallic minerals that occur in the quartz veins and adhering slate and quartzite are crushed up with the gold in the process of extraction; and, no doubt, likewise whilst iron and copper are abstracted from the stamping boxes and machinery during amalgamation, lead, silver, &c., are probably introduced from impurity of the mercury employed. The principal minerals of the auriferous quartz veins here are zinc blende, galena, iron and copper pyrites, and mispickel (arsenical pyrites); which last abounds in some mines, and causes inconvenience to the workmen, if the ore be roasted before crushing."

In all our mines the gold is separated by the method of amalgamation. The quartz is pulverised in a strong iron stamping box, which rests on a heavy granite block to resist the continual action of the heavy piston hammers. The stamping box contains mercury, and has a continuous supply of water. The powdered quartz is continually floating out, as a silt or "slime," through a wire gauze arrangement, and is carried in a small shallow sluice over little sunken cups or pools filled with mercury, then through a series of sluices or "shaking tables" lined with copper, the surface of which has been rubbed or amalgamated with mercury; these shaking tables are arranged one under the other like steps of a staircase, and have a continued oscillating motion, whilst the stream of water (hot or cold) runs from one to the other, carrying the slimes. Thus the process goes on continuously,—a "crusher," as it is called, being in reality a mill in which the various processes of pulverising, washing, and amalgamating go on during the week without interruption. A crusher usually consists of a number of stamping boxes, and relative sluices, and other arrangements, such as described, arranged parallel to each other, so that two or three men may conveniently feed the whole of the stamping boxes. The mercury takes up the gold from the sluices as they pass over its surface, and the amalgamated surfaces of copper slowly become incrustated with a dull pasty coating. This pasty substance of a leaden colour is the gold amalgam, a chemical compound of gold and mercury. Once a week the mill is stopped, or it may be once a fortnight, or once a month, and the pasty incrustation is carefully scraped away from the shaking tables and sluices, the mercury is taken out of the cups or grooves, and the whole put into an iron retort; heat is applied, the mercury is distilled off to be used again for the absorption of fresh supplies of the precious metal, and the gold is found at the bottom of the retort in the form of a more or less porous and impure mass. It is melted to get rid of impurities, and is then ready to be sent in the form of a brick or bar to the bank or mint.

The process lately invented by Mr. Crookes, by which sodium amalgam is added to the mercury, has not yet been taken advantage of to any extent in our mines. I have experimented to a considerable extent on the effects of sodium amalgam, and find it to exert a very remarkable power in facilitating the absorption of gold by mercury, quite independently of any action of the soda necessarily formed during the operation. I believe, therefore, that much benefit would result from the use of Mr. Crookes's amalgam. The coating of the copper surfaces with mercury alone has been found practically to be a troublesome and tedious operation; but the use of a little sodium amalgam added to the mercury enables the coating to be given by a simple rubbing without any waste of time. Some illustrations of the advantages of Mr. Crookes's process were given in a paper which I published last year in the *Transactions* of our Institute of Natural Science.* It was stated that in some experiments undertaken in conjunction with Dr. Krackowizer, formerly of Vienna, at the Lake Major Mines, a quantity of pyrites collected from the tailings (after passing through the mill in the usual way) was re-subjected to the action of mercury, to which sodium had now been added, and by this means the waste material from which all the gold was supposed to have been abstracted, yielded a fresh supply at the rate of five ounces of gold per ton of pyrites. In the washing of alluvium, during which there is a great loss of mercury from "flouring," the advantages of Mr. Crookes's process were equally obvious.

Professor ANDERSON, in proposing thanks to the author of this paper, asked Mr. Crookes, who was in the room, if he could give any further details respecting the sodium process of amalgamation of which he was the inventor.

* "On some recent Improvements in the Amalgamation Process for Extracting Gold from Quartz." By George Lawson, LL.D. *Trans. Inst. Nat. Science of Nova Scotia*, part iv., pp. 71-76.

Mr. CROOKES said that there was one thing which ought especially to be attended to in employing this process, and that was to avoid introducing too much sodium. Every failure which had come under his notice had arisen from ignorance of the action which the sodium was intended to exert on the mercury. If too much were added it exerted a chemical action, reduced the iron, copper, lead, &c., which might be present in the ore, and loaded the mercury with base metals, destroying its power of wetting gold, and causing it rapidly to flour away when triturated in a stream of water. If, however, only a trace of sodium were introduced (say 1 in 10,000 or 1 in 100,000), it acted physically rather than chemically; it put the mercury into a highly electro-positive state, and by greatly widening the electric interval between this metal and gold, increased their mutual affinity.

Professor WILLIAMSON said that some specimens of auriferous pyrites had been brought under his notice, containing as much as 25 ounces of gold to the ton, and which yielded nothing whatever by the ordinary mercurial treatment. He was anxious to know from Mr. Crookes whether his sodium process would extract the gold, and would also enquire whether it was known in what state of combination the gold existed.

Mr. CROOKES replied that the general opinion was that the gold existed in auriferous pyrites in the metallic state, and not as a single or double sulphide. The gold was sometimes visible in plates between the crystals of pyrites, and was frequently left behind in the form of brilliant spangles and crystals on dissolving the pyrites in acid.

Although mercury in its ordinary state would not extract the gold from pyrites, the addition of a trace of sodium conferred this property upon it, and in skilful hands it was easy to obtain almost the assay quantity of gold without appreciable loss of mercury by flouing.

Monday, September 9th.

The meeting was very well attended this morning. The first paper was one entitled,

"Remarks on the Calculus of Chemical Operations."

By Dr. A. CRUM BROWN.

This was followed by an exceedingly animated discussion, in which Professor Clerk Maxwell, F.R.S., Rev. Professor Harley, F.R.S., Mr. A. R. Catton, Professor Wanklyn, Dr. Odling, F.R.S., and Dr. Williamson, F.R.S., took part. The line of argument was somewhat similar to that adopted on the occasion of the discussion of Sir B. Brodie's paper at the Chemical Society, and the general feeling was adverse to the introduction of so radical a change as that advocated by Sir B. Brodie, although most of the speakers appeared disposed to reserve their opinion till the publication of the second part of the "Calculus of Chemical Operations." Time will not admit of our preparing an abstract of the paper and discussion in time for publication this week.

This was followed by a paper—

"On certain New Processes in Photography."

By J. SPILLER, F.C.S.

I have the pleasure of submitting to the notice of the Section several interesting results and improvements in photography, based, it may be said, on the chemistry of gelatin. The processes to which I refer are the various modifications of the Woodbury type, including the new method of micro-photo-sculpture, the art of photo-lithography, as practised in the Royal Arsenal at Woolwich; and some illustrations of the use of gelatin or albumen, on a foundation of silk, satin, or cambric, the work of H. P. Pritchard, of the War Department.

The Hon. H. Fox Talbot was one of the first to describe and make a practical use of the action of light upon a mixture of gelatin and a soluble bichromate, and after him Colonel Sir Henry James, Mr. Swan, of New-

castle, and Mr. Woodbury, of Manchester, have applied the same chemical principle in new directions. It is known that the chemical rays of light have the effect of rendering insoluble gelatin to which a bichromate has been added. It would appear that this oxidising salt hardens the animal substance, by forming with it a combination of chromic oxide. In proof of this view, it may be stated that Mr. Swan has lately devised a mode of working, in which a minute quantity of chrome alum or sulphate of chromium is used instead of the red chromate, and it is found that when dried this mixture is not again affected by water. The carbon prints of Mr. Swan, which were exhibited and so much admired last year at Nottingham, are illustrations of the use of a chromate in conjunction with gelatin and pigments. Mr. Woodbury's process is also based on the insolubility of the chromo-gelatin after exposure to light, and upon the subsequent action of water upon a sensitive film, which has been in different degrees influenced by insolation under an ordinary photographic negative. The depths of tint in the original are represented by variations in the thickness of the film of gelatin left unacted upon by water, and this dried may then be used as a matrix to produce a corresponding series of depressions upon a surface of lead or type metal by the aid of a powerful hydraulic press. The blocks so produced serve for printing off a great number of proofs when they are liberally "inked" with warm gelatin, highly charged with Frankfort black or other suitable pigment, and pressed down upon a smooth sheet of paper until the excess of ink is forced out on all four sides of the block, and so removed from the space constituting the picture, which, when set, is, lastly, protected with a varnish of collodion. (Specimens of the Woodbury type were exhibited.) A glass plate may be used instead of paper to receive the ink, and this, backed with another (opal) glass, gives an excellent result, suitable for a variety of ornamental purposes. (Specimen shown.)

Mr. Woodbury has lately perfected a modification of his process, which is applicable to the representation in high relief of microscopic objects. The method consists in spreading a warm solution of gelatin, containing a little sugar and chromate of potash, over a glass plate previously coated with collodion. The film sets on cooling, and is then placed in contact with an ordinary photographic negative of the microscopic objects to be delineated, exposed to light, submitted as before to the action of water, and the soluble portions washed away. When the surface moisture has evaporated, a mixture of plaster of Paris, containing a small proportion of alum, is poured over the relief to the thickness of half-an-inch, and left to set. When dry it will be found, owing to the alum in the plaster hardening the surface of the gelatin, directly on coming in contact therewith, to leave the gelatin easily, without any fear of adhesion. To give a finished appearance to the resulting casts, this intaglio, when dry, may be placed in a lathe, and a suitable border turned on it, which will be represented in the resulting proofs by a raised border, similar to what is seen on medallions or plaster casts. The name of the object may also be neatly engraved on the intaglio, to appear in raised characters on the reliefs. This intaglio should then be well waxed to fill up the pores, and is ready for taking any number of impressions in plaster; or a better plan is to take one in plaster, and having smoothed away any defects to mould a reverse in sulphur, which will give a greater number of fine impressions. (Specimens exhibited.)

Great progress has been made during the last year in perfecting the details of photo-lithography, and the results which I now exhibit are illustrations of the practical use of this art as a means of procuring on a reduced scale printed reproductions of the large series of lithographs used for the use of the British army by the Royal Carriage Department. Negatives of the required size are taken in the first instance by the collodion

process, this service being performed in the photographic establishment of the War Department at Woolwich, under my supervision. The pictures are then copied upon a sensitive surface, prepared by floating a sheet of bank post paper upon warm chromo-gelatin solution, made as follows:—I. Gelatin, 3 oz.; hot water, 40 oz. II. Bichromate of potash, 2 oz.; hot water, 10 oz. The two solutions are mixed together, and should then be kept from the light. The prepared side of the paper is taken dry, laid against the negative, and for a short time is exposed to light. It is then greased all over by spreading a thin layer of "litho-transfer ink" upon stone, and passing through a lithographic press, and the whole surface is in the next place submitted to the action of warm water thickened with gum. The ink resting upon the unexposed portions of the print is thus removed, the gelatin in these parts remaining perfectly soluble, and the paper is washed with dilute gum water, using a sponge to assist in detaching the loosened layer of ink, and finally washed with warm water alone. This sheet of paper is an accurate transcript in lithographic ink of the original photograph. All the lines should be clear and sharp, and there will be no difficulty in transferring to stone and printing off any required number of impressions by following the details of the ordinary lithographic process. The cost of production is very trifling, and a large number of prints, both plain and coloured, have been executed in this manner by Mr. Henry Butter, of the Royal Carriage Department. I have, lastly, to show a few specimens of photographs printed on silk, satin, and cambric, the work of Mr. H. B. Pritchard, of the W. D. He produces them by salting the fabrics with the following solution:—Common salt 5 grammes; water, 500 cubic centimeters; albumen, the whites of four eggs. The air-dried fabric is then sensitised, printed, and fixed, in the ordinary manner, but with as little delay as possible. This method furnishes a means of reproducing photographs upon a stronger and more flexible basis than paper, and is particularly applicable for diagram purposes and architectural plans; we have used it in the Royal Arsenal for preparing sketches, and illustrated descriptions for military instruction and use in the field.

A discussion followed.

The next paper was one

"On a New Polarising Photometer."

By W. CROOKES, F.R.S.,

which will appear in our next.

MEETING OF THE GENERAL COMMITTEE.

A meeting of the General Committee was held on Monday afternoon for the purpose of determining the place of meeting of the British Association next year. His Grace the Duke of Buccleuch presided, supported by Sir Roderick Murchison, Dr. William Fairbairn, Professor Phillips, Sir John Lubbock, Prof. Tyndall, S. M. E. Grant Duff, Esq., Sir John Bowring, and the Earl of Enniskillen.

Deputations were present from Plymouth, Exeter, Norwich, Liverpool, and Edinburgh, inviting the British Association to meet in their respective towns next year. After a discussion the claims of Norwich carried the day, and it was decided that the British Association should meet in that city, in August 1868, under the presidency of Dr. Joseph Dalton Hooker, M.D., D.C.L., F.R.S., &c.

The following gentlemen were appointed Vice-Presidents for the next year's meeting of the Association:—The Earl of Leicester, Lord-Lieutenant of Norfolk; Sir John Peter Boileau, Bart.; Sir John Lubbock, Bart., F.R.S., the Rev. Adam Sedgwick, M.A., F.R.S., &c., Woodwardian Professor of Geology in the University of Cambridge; J. Couch Adams, Esq., M.A., D.C.L., F.R.S., Lowerdean, and Professor of Astronomy and Geometry in the University of Cambridge; Thomas Brightwell, Esq.

Dr. Dalrymple, Rev. Canon Hind Howell, and Rev. J. Crompton were appointed Local Secretaries; and S. Gurney Buxton, Esq., and Roger Kerrison, Esq., were appointed Local Treasurers for the meeting at Norwich.

In the evening Professor Alexander Herschel, F.R.A.S., of Glasgow, delivered a lecture on Meteors and Meteorites, in the Kinnaird Hall, which was crowded by a very brilliant audience.

A report of this lecture is unavoidably postponed for want of space.

On Tuesday the Chemical Section met as usual, when the following papers were read:—

I. Lothian Bell.—*On the Present State of the Manufacture of Iron in Britain, and its position as Compared with that of some other countries.*

J. B. Lawes and J. H. Gilbert.—*Preliminary notice of Results on the Composition of Wheat, grown for twenty years in succession on the same land.*

R. F. Smith.—*On the Gaseous Products of the Destructive Distillation of Hydrocarbons, obtained from Shales and Coals at low and high temperatures.*

P. Spence.—*On the Economisation of the Sulphurous Acid in copper smelting.*

W. L. Scott.—*On the Bisulphide of Calcium as a preservative of animal substances.*

W. L. Scott.—*Note on the Artificial Production of Oil of Cinnamon.*

T. T. P. Bruce Warren.—*On the Electrical Resistances of the Fixed and Volatile Oils.*

Full reports of these papers are in hand, and will appear next week.

CONCLUDING MEETINGS.

A meeting of the General Committee was held on Wednesday, Sept. 11. The Secretary read the grants of money for scientific purposes, from which we extract the following:—Dr. Anderson, Synthesis of Organic Acids, £60; Mr. E. R. Lankester, Investigation of Animal Substances with the Spectroscope, £15; Dr. Bennett, Action of Mercury on the Secretion of Bile, £25; Dr. Richardson, Physiological Action of the Methyl Series, £25. The Secretary then read the recommendations not involving money grants, which included resolutions relating to the continuation of storm signals; and the introduction of the metric system to government schools. These were referred to the Council of the Association. It was also recommended, in Section A.—That the Metrical Committee be re-appointed; that Professor Stokes be requested to continue his researches in physical optics; that Mr. Low, Mr. Glaisher, Dr. Moffat, Mr. C. Brooke, Dr. Anderson, and Dr. Ward Richardson be a Committee for the purpose of promoting accurate meteorological observations on ozone; that Dr. Tyndall, Dr. Lyon Playfair, Dr. Odling, Rev. C. Pritchard, Professor Kelland, Professor W. A. Miller, and Professor Foster, be a Committee for the purpose of enquiring into the present system of teaching the elements of dynamics, experimental physics, and chemistry in schools of various classes, and of suggesting the best means of promoting this object, in accordance with the recommendations of the report of the Committee appointed by the Council of the British Association, and that Professor Foster and Dr. Odling be the Secretaries. Section B.—That Dr. Matthiessen be requested to continue his researches on the chemical constitution of cast iron; that Mr. Fairley be requested to continue his researches on the polycyanides of the organic radicals; that the Committee on Scientific Evidence in Courts of Law, consisting of the Rev. William Vernon Harcourt, Professor A. W. Williamson, the Right Hon. J. Napier, Mr. W. Tite, Professor Christison, Mr. Carpmal, Dr. Tyndall, Mr. J. Heywood, Mr. J. F. Bateman, Mr. G. Webster, Sir B. Brodie, and Professor W. Allen

Miller (with power to add to their number) be re-appointed, and that Professor Williamson be the Secretary. The Secretary then read a recommendation:—That the President of the Association be requested to communicate the report of the Committee appointed by the Council to consider the best means for promoting scientific education in schools, to the President of the Privy Council, and to the Parliamentary Committee, on the part of the Association; and that the general officers be authorized to take steps to give publicity to the report. Dr. Richardson intimated that at the next meeting of the General Committee he would move that a Section for Applied Science should be formed. The concluding general meeting of the Association took place in the afternoon, at three o'clock. Mr. Griffiths made the following statement of the number of tickets which had been issued on the occasion of the Association meeting in Dundee:—167 old life, 25 new life members, 193 old annual, 118 new annual, 1,163 associates; 771 ladies, and 7 foreigners; total, 2,444.

MISCELLANEOUS.

Rapid Reporting.—We would draw attention to the promptness, hitherto unknown in the scientific press, with which the proceedings of the British Association were reported last week in these columns. It should be remembered that Dundee is fifteen hours' railway journey from London; but the *CHEMICAL NEWS*, which was in the hands of the public on Friday morning last, contained a full account of the proceedings in Section B of the previous day. Not only was Dr. Anderson's introductory address given in full, but the two most important papers were also reported, and the discussion given. All the important papers have been reported for us verbatim, and the discussions and papers of minor importance are reported in abstract; but our available space, although extended by the issue of a supplement, is still insufficient, and we are reluctantly compelled to defer the concluding part of the proceedings till next week.

Origin of Gypsum and Dolomite.—In a memoir read before the *Académie des Sciences*, 22nd April, this year—"Sur la formation des gypses et des dolomies" (*Compt. Rend.*, tome lxiv., p. 815), Dr. Sterry Hunt gives the results of an interesting experimental investigation on the origin of these rocks. After alluding to a previous communication to the Academy (23rd May, 1859), in which he demonstrated that the mutual reactions of bicarbonate of lime and sulphate of magnesia would give rise to the formation of gypsum and hydrated carbonate of magnesia, he proceeds to account for the origin of the carbonate of magnesia, which, under the form of dolomite, is found so abundantly in nature, unaccompanied by gypsum. He regards in the first place the carbonates of soda, lime, and magnesia to have been formed from the decomposition of primitive silicates by atmospheric carbonic acid, and that the carbonate of soda so formed precipitated first the lime and then the magnesia (more or less mixed with lime) from the primeval ocean; in cases of isolated basins of water previously deprived of its lime, carbonate of magnesia would be alone precipitated. The most important point in this investigation, however, is the discovery announced by Dr. Sterry Hunt of the mode in which the chemical reactions concerned in the production of dolomite and gypsum are modified under the influence of an atmosphere of carbonic acid, from which he infers that the ancient period was much more favourable to the development of these rocks, since the atmosphere of the primitive epoch must doubtless have contained much more carbonic acid than at present; and concludes by ascribing to this cause the production of the great masses of gypsum associated with dolomites which are found in the most ancient formations up to those of the tertiary period.

M.P. for London University.—Candidature of Sir John Lubbock.—An influential meeting was held, in the Committee Room of Section D, of gentlemen anxious to assist the Committee of Graduates formed to secure the election of Sir John Lubbock as representative of the University of London. Among those present were—Sir W. Thomson, President of Mathematical and Physical Section; Dr. Sharpey, President of the Section of Anatomy and Physiology; Prof. Busk, President of the Section of Zoology and Botany; Prof. Wheatstone; Prof. Sylvester; Prof. Tyndall; Prof. Allen Thomson; Prof. Ansted; Dr. Williamson; Mr. Gassiot; Prof. Hirst; Dr. Odling; Dr. Turner; Prof. M. Foster; Prof. G. C. Foster; Dr. A. C. Brown; &c. Professor Tyndall was in the chair; and it was proposed by Sir William Thomson, and seconded by Professor Williamson, and carried unanimously:—"That Sir John Lubbock, Bart., having been brought forward by an influential party among the graduates of the University of London, and an opportunity being thereby afforded of obtaining for science a representative in the House of Commons, it is highly desirable that those who are interested in science should do all in their power to secure his election."

NOTES AND QUERIES.

The Word Aneroid.—Aneroid is derived from the Greek *an* privative—without, *νηρος*—wet, damp, or fluid, *i.e.*, barometer without mercury, or fluid.—A.

Phthalic Acid.—Sir,—Can any of your readers give me the details of the manufacture of phthalic acid?—NAPHTHALINE.

Preservation of Crystals.—Sir,—In reply to "Cassio's" query last week, I beg to suggest that benzol is an excellent medium in which to preserve fine crystals. Most aqueous salts are insoluble in benzol. They can be removed for examination, and after a few minutes' exposure to the air the smell of benzol will have disappeared. If immersion in a liquid is objected to they may be oiled. Many crystals which change and become dull by exposure to air, as alum, sulphate of copper, sulphate of iron, ferro-cyanide of potassium, &c., if slightly oiled, do not then alter in a long time, and many efflorescent substances are prevented from changing by the same means. Even crystals of sulphate of soda may be exposed to the air for weeks together without efflorescing if well oiled. The plan is to soak the crystals in fine olive oil for a few hours, then to wipe them on soft cambric and put them in bottles.—A. THOMPSON.

Platinising Metals.—Sir,—I can recommend my fellow-reader who applies for information on this subject to adopt the following process, given by Professor Church, in the *Intellectual Observer*, some time back:—"Dissolve in one ounce of distilled water sixty grains of bichloride of platinum and sixty grains of pure honey. Add to the above solution three-quarters of an ounce of spirits of wine, and one-quarter of an ounce of ether. The mixed liquids, if not quite clear, must be filtered through a piece of white blotting-paper. The objects to be platinised, which may be of iron, steel, copper, bronze, or brass, are to be thoroughly cleansed by washing them in soda, then in water. When they have been dried, they require heating over a lamp, to a heat below redness. For this purpose they may be suspended, by means of a fine wire, over a spirit or an oil lamp, in such a way as not to touch the flame. Suddenly, before they have had time to cool, the objects are to be completely plunged beneath the surface of the platinising liquid. One immersion for a single minute generally suffices; but the process may be repeated if necessary, care being taken to wash and dry the pieces operated upon before re-heating them. The composition of the solution may vary considerably, and yet good results be obtained. Sometimes the addition of more honey improves it; sometimes the proportion of bichloride of platinum may be increased or diminished with advantage. Indeed, it will be found that the appearance of the platinum film deposited upon the objects may be altered by changing the proportion of the bichloride present. The solution may be used several times; gradually, however, it loses all its platinum, the place of this element being taken by the iron or copper dissolved off the immersed objects." I have tried the plan and found it very successful. I am very happy to contribute my mite towards a column which has frequently given me more information than any other in your valuable journal.—E. BEAZLEY.

TO CORRESPONDENTS.

To Correspondents.—In consequence of the lengthy report of the British Association meeting we are compelled to postpone our Answers to Correspondents till next week.

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THE CHEMICAL NEWS.

VOL. XVI., No. 407.

AN IMPORTANT ADJUNCT TO THE INDUCTION COIL.

By HENRY MORTON, Ph.D.

The arrangements I am about to describe have proved of great value to me, and will, I presume, be of like use to others who may have need of similar lecture illustrations.

Take eight plates of glass, about 11 inches by 14 inches, and attach to both sides of each plate sheets of tinfoil 7 inches by 10 inches in size, with rounded corners. Set these plates upright in a box (provided with grooves for the purpose) about 1½ inches apart; then, rolling up some balls of paper large enough to fit between the plates, and wrapping a strip of tinfoil around each ball, thrust them between the plates, and, lastly, make an outside pole to the terminal sheets of foil by means of wires enclosed in glass tubes passed through the side or top of the box. It is evident that we have here a compact form of Leyden battery arranged for "cascade." With the ordinary electrical machine such an arrangement would be worthless from its want of insulation. With the induction coil, however, which develops an entire charge in an instant, it becomes of great value in a certain class of experiments, because it gives us at once the concentrated charge peculiar to the Leyden battery, combined with a spark length which it otherwise lost. (This property of long spark in the "cascade" arrangement of jars is well known.)

If such an apparatus as we have just described be connected with the secondary poles of an induction coil, and other wires are then led off (with a break in the circuit, however, of ¼ to ¾ inches) to some piece of apparatus for the illustration of electric discharge in vacuo, such as Gassiot's cascade (especially with a canary goblet), the Aurora tube, an electric egg of canary glass, &c. (but not a Geissler tube), the brightness of the illumination and volume of the discharge will be immensely increased. Thus a goblet invisible at 30 feet when the unaided coils used, becomes *brilliant* at 50 feet with this attachment. I have used two coils with the above apparatus, both made by Mr. E. S. Ritchie, of Boston, one (which is my own property) yielding a spark of 8 inches, the other (also in my hands, as it belongs to the Physical Cabinet of the University of Pennsylvania), which gives, in its present mounting, sparks of 16 inches, but is capable of yielding sparks two feet in length. Such sparks were, in fact, obtained from it by Mr. Ritchie during its manufacture; but, in mounting it, the poles have been secured at a maximum distance of 16 inches to provide against accident, such a length being abundantly sufficient for use. How the above battery would work with smaller coils I cannot say. Geissler tubes, unless of very large area, are not benefited in appearance by this arrangement; because, as I believe, the coil unaided can supply all the electricity they are capable of transmitting, and this excessive charge only tends to develop inductive resistances in the glass tubes themselves, which resistances this *momentary* current is the least fitted to overcome.

Allow me to mention another little practical detail in this connection. It is generally assumed that the induction coil is unfit for the exhibition of those experiments of attraction and repulsion which especially characterise statical electricity. A great number, however, may be very satisfactorily exhibited by charging Leyden jars and using them as the sources of electricity. Thus, connect a

chime of bells with the knob of a large jar, connect the outer coating with the earth and with the negative pole of the coil; then bring the positive pole within striking distance of the knob, and charge by a few sparks. The electrical flyer, orrery, sportsman and birds may be successfully operated in this way, even in summer weather.

Probably, however, the coil should not be of less than 6 inches spark length.

University of Penna, Philadelphia.

ON THE SO-CALLED "INACTIVE" CONDITION OF SOLIDS.

By CHARLES TOMLINSON, F.R.S.

IN the CHEMICAL NEWS for the 2nd of August is given a notice of my paper on the above subject, in which I endeavour to prove that the action of solids in disengaging gases from their solutions, or in inducing crystallization in saline solutions, is simply a question of adhesion depending on the state of purity of the surface of the solid. I have since endeavoured to express my theory in such general terms as to embrace a larger number of phenomena, which indeed seem to increase the more it is examined.

My theory, as it now stands, is as follows:—

Any supersaturated solution of gas, with its upper surface freely exposed to the air, is always giving off that gas, either with effervescence, or silently and imperceptibly. It does so because the excess of gas has only a slight adhesion for the liquid, and the air is virtually a vacuum for it, the only difference being, that it would pass off into a real vacuum suddenly and instantaneously. The remaining surface of the liquid, or that confined by the sides of the vessel, is in exactly the same state, subject however to two conditions—(1) the purity of their surface, and (2) the pressure exerted by them (virtually) on the liquid.

(1.) Suppose the vessel to be chemically clean. No gas will be disengaged, and no bubbles will form on the sides, because the adhesion between the sides and the liquid is perfect. Hence the sides may be considered, *pro rata*, as merely a continuation of the liquid itself, and no bubbles will form there any more than in the central parts of the liquid. But suppose the sides to be dirty, adhesion is diminished or annulled; and therefore the surface of the liquid next to such sides is virtually as free as its upper surface. (2.) Hence bubbles will form here, just as they form on the upper surface; but in the latter case they do not appear as bubbles (except in effervescence) because there is no pressure. The sides do exert pressure, and therefore bubbles are formed. Now it does not at all matter whether there be air or not between the sides and the liquid: there may probably be a vacuum or any other gas. The result will be the same. Hence it is futile to talk of the air as disengaging bubbles, as in M. Gernez's theory; it is really want of adhesion. Now to apply this to the case of the so-called "inactive" glass rod. A rod, a coin, a piece of flint, &c., placed in the liquid, does nothing more than form new sides, as it were, to the vessel, and its effect is merely that of the sides. If chemically clean, the rod, &c., will form no bubbles round it, and it is called "inactive" because its adhesion is perfect. If dirty, the surface of liquid in contact with it, will be as free, or almost so, as the upper surface.

The same theory applies equally well to the action of *nuclei* in inducing crystallisation. It also applies to the common theory of ebullition, and the action of the vessel in raising or lowering the boiling-point under the same pressure. Writers down to our own day state that water boils at about 105° C. in a glass vessel, and at 100° in a

metal vessel; at a lower temperature in vessels whose internal surfaces are rough than in smooth ones; that *bumping* is produced when the liquid has comparatively little adhesion to air; and soon I think it can be proved that these and other phenomena which figure in our text-books as remarkable facts, can be explained with reference to the same law of adhesion, and have nothing to do with the air except indirectly.

King's College, London, Aug. 31, 1867.

REVISION OF THE MINERAL PHOSPHATES.

By A. H. CHURCH, M.A.,

Professor of Chemistry, R. A. College, Cirencester.

Continued from vol. XII. p. 183.

No. VI. OSTEOLITE.

A STATEMENT appears in some chemical works to the effect that osteolite, a white and compact mineral not unlike fine lithographic stone, is really pure tricalcic diphosphate $\text{Ca}_3\text{P}_2\text{O}_8$. All the analyses, however, of this substance which have been published, point to a very different conclusion; and, in fact, a pure native tricalcic diphosphate is still unknown. My analyses of specimens of osteolite from various localities serve to confirm the notion that this so-called species is merely an apatite more or less altered by the substitution of calcic carbonate for the chloride or fluoride.

One of my specimens was from Eichen, Wetterhau. It was white, hard, and tough, showed slight signs of being stratified, and had a density of about 2.86. The following are the analytical results:—

35.46 grains osteolite gave	...	83 grain	H_2O
" " " "	...	30.97	" $\text{Ca}_3\text{P}_2\text{O}_8$
" " " "	...	4.26	" CaCO_3
55.32 " " " "	...	1.39	" CO_2

From these results we find that more lime was present in the mineral than sufficed to saturate the phosphoric and carbonic acids. Qualitative tests revealed the presence of much fluorine. If the remainder of the calcium be calculated as if in union with fluorine, the following satisfactory percentages are shown:—

$\text{Ca}_3\text{P}_2\text{O}_8$	...	87.25
CaCO_3	...	5.70
CaF_2	...	4.92
H_2O	...	2.34
		100.21

Osteolite, therefore, cannot rank as a distinct species: it is a more or less altered apatite.

ON THE REFRACTION EQUIVALENTS OF SALTS IN SOLUTION.*

By J. H. GLADSTONE, F.R.S.

THE British Association has already more than once heard of "refraction-equivalents," but for many chemists the term may still require definition. It is well known that every body has the power of bending a ray of transmitted light, and that this power may be expressed by a number, termed the "refractive index." Now this "refractive index," minus unity, divided by the density of the body, is termed its "specific refractive energy,"—a property of great importance, and one that accompanies the body, notwithstanding great physical or chemical changes; for instance, to quote words formerly used, "as

a rule, when a gas, liquid, or solid dissolves in water, it preserves its specific refractive energy."* For many purposes it is convenient to multiply this number by the atomic weight of the substance, and that is termed its "refraction-equivalent."

Now it is not difficult to arrive at the refraction equivalent of a salt in solution. Let a weight of it, answering to its chemical equivalent, be dissolved in a certain number of equivalents of water; the refraction-equivalent of the whole solution will consist of the refraction-equivalent of the salt, plus so many times the refraction-equivalent of water; and as this number is known, we have only to subtract it from the whole to obtain the refraction equivalent desired.

It occurred to me that if a series of salts in solution were thus examined, I might arrive at numbers from which many interesting facts might be deduced, and especially that it might afford data for determining the refraction-equivalents of all the metals, and of those substances with which these metals will combine to form soluble salts.

As the determinations are matters of great delicacy, especially when the solutions are weak, I am having a superior apparatus made by Mr. Browning for the purpose; but some preliminary observations have been made with the old apparatus of Baden Powell, and these perfectly confirm my expectations, and induce me to undertake a careful examination of the whole subject.

In the first place I prepared solutions of iodides, bromides, and chlorides. The metallic iodides gave refraction-equivalents ranging from 30.5 to 35.3; the metallic bromides from 21.7 to 25.3; and the metallic chlorides from 15.1 to 18.6, the highest number in each instance being the potassium salt, while the ammonium compounds of these halogens gave numbers more than three higher. Again, it was at once evident that the dispersion-equivalent of an iodide was at least double that of a bromide, and three times that of a chloride. On comparing the salts of the same metal this difference between the halogens was still better defined, the number for the iodide almost invariably exceeding that for the bromide by a little more than ten, and that for the chloride by a little more than sixteen. It was evident, therefore, that the halogen was exerting the same influence on the rays of light with whatever metal it was combined; and that any metal, as calcium, was unchanged in its refraction-equivalent, whether it was united to chlorine, bromine, or iodine. This observation was subsequently extended to a totally different class of salt, the sulphates, which give numbers always about one less than those given by the chlorides.

It may be asked—What numbers do you deduce from these results as to the refraction-equivalents of the metals? Unfortunately I am not in a position to reply with certainty. If we knew the refraction-equivalents of chlorine, bromine, or iodine, it would be easy; but the numbers previously deduced for them from organic compounds evidently require some rectification before they can be applied to this purpose. I hoped to arrive at the matter from the refraction-equivalents of the hydracids in solution, as the number for hydrogen is known to be 1.3; but I obtained such high numbers for hydriodic, hydrobromic, and hydrochloric acids, that I am disposed to think hydrogen in these compounds must exert a far greater refractive influence on the rays of light than when alone, or combined with carbon or oxygen.

In any case the refraction-equivalents of the metals examined in solution are very low as compared with the known refraction-equivalents of non-metallic bodies, except those that have very small atomic weights. They present themselves in about the following order, commencing with the lowest:—Magnesium; lithium; sodium; zinc; calcium; manganese; cadmium; copper; strontium; iron (ferric); barium; potassium; ammonium.

* Read before the British Association, in Section B.

* Journ. Chemical Society, May, 1865.

ON THE COMMERCIAL ANALYSIS OF SOME OF THE PRODUCTS AND MATERIALS OF THE ALKALI MANUFACTURE, &c.

By C. R. A. WRIGHT, B.Sc., F.C.S.

(I.) Salt-cake.—Ordinary salt-cake is valued according to the percentage of "Available sulphate of soda" contained; i.e., the percentage of Na_2SO_4 existing mainly as such, and partly as NaHSO_4 . The mode of estimation of the available sulphate usually pursued is the following:—

1. The NaCl is determined volumetrically by a standard silver solution.

2. The quantity of a standard alkaline solution required to render a known weight of salt-cake exactly neutral to test papers is determined, and the result, sometimes calculated as SO_3 sometimes, as SO_4H_2 , called "free acid."

3. The difference between the sum of the two previous determinations and 100 is assumed to be "available sulphate of soda."

By this mode of proceeding errors of one to three or more per cent are introduced; ordinary salt-cake containing, in addition to Na_2SO_4 , NaHSO_4 , and NaCl , perceptible quantities of PbSO_4 , $\text{Fe}_2(\text{SO}_4)_3$, Fe_2O_3 , CaSO_4 , MgSO_4 , moisture, and particles of sand, brick, &c., derived from the furnace during the manufacturing processes. Where a greater degree of accuracy is desirable, a known weight of salt-cake may be treated with water, ammonia and ammonium oxalate added to the unfiltered solution, and the precipitated Fe_2O_3 and CaCO_3 , with the insoluble matters, weighed after ignition: by moistening the ignited precipitate with pure SO_4H_2 , and igniting again, the CaCO_3 is converted into CaSO_4 , and then the weight of the mixed substances indicates all the "impurities" present in the salt-cake, with the exception of the MgSO_4 , which rarely amounts to more than traces, and the moisture, which is occasionally a very perceptible quantity, especially in samples that have been made some length of time.

The amount of ferric sulphate present depends on the degree of heat to which the salt-cake has been subjected during manufacture. In highly roasted samples, cold water yields a solution containing no iron whatever, all the iron present in the salt-cake consequently existing as Fe_2O_3 ; specimens of under-roasted salt-cake, on the other hand, when treated with cold water, leave only fragments of brick, CaSO_4 , &c., undissolved, all the iron existing as $\text{Fe}_2(\text{SO}_4)_3$. In ordinary salt-cake, however, there is so little ferric sulphate, that no perceptible error is committed in assuming that all iron present exists as Fe_2O_3 , and all the "free acid" as NaHSO_4 . Accordingly the following methods have been found to give tolerably expeditiously the exact composition of such salt-cake.

(a.) A known weight, 5 or 10 grammes, is dried at 110° — 120° C., till constant in weight; too great elevation of temperature being avoided to prevent any possible loss of HCl by reaction of the NaHSO_4 on the NaCl present.

(b.) The NaCl is determined volumetrically by a standard silver solution.

(c.) A solution of sodium hydrate free from carbonate, or of caustic ammonia, of known strength, is added to a known weight of salt-cake until test-papers indicate exact neutrality of the liquid; the alkaline solution used accordingly corresponds to the $\text{Fe}_2(\text{SO}_4)_3$ and NaHSO_4 together, and may therefore be safely calculated as the latter.

(d.) A known weight of salt-cake is boiled with an excess of a standard sodium carbonate solution, and filtered; the unneutralised alkali is then determined by a standard acid solution. The amount of alkaline solution neutralised by the salt-cake indicates the CaSO_4 , NaHSO_4 , and $\text{Fe}_2(\text{SO}_4)_3$ together; and hence the difference between

(c) and (d) indicates the CaSO_4 . Or the CaSO_4 may be determined gravimetrically by precipitation with ammonium oxalate after separation of the Fe_2O_3 by ammonia from the solution of a known weight of salt-cake in hydrochloric acid.

(e.) The precipitate thrown down in (c) may be collected and boiled with hydrochloric acid; the insoluble bricks, &c., may be weighed, and the ferric salt reduced by zinc or other reducing agent, and titrated volumetrically by permanganate or otherwise.

(f.) When the PbSO_4 is to be determined, it may be done by treating a considerable quantity, say twenty grammes, with water, and boiling the insoluble residue with strong hydrochloric acid, till the PbSO_4 is entirely dissolved, and from the solution PbS may be thrown down by sulphuretted hydrogen, and the lead determined in the ordinary way.

(g.) If MgSO_4 is to be determined, it may be done by dissolving a known weight, say twenty grammes, in hydrochloric acid, adding ammonia and ammonium oxalate, and precipitating the magnesia from the filtrate by a phosphate, and ultimately weighing the magnesium pyrophosphate.

(h.) If the preceding determinations have been carefully conducted, the difference between 100 and the sum of them may be safely taken as Na_2SO_4 ; if this is to be directly determined, however, it may be done either by determining the total SO_4 present by dissolving a known weight of salt-cake in hydrochloric acid, and precipitating by BaCl_2 , and weighing the BaSO_4 ; subtracting the SO_4 contained as CaSO_4 , NaHSO_4 , MgSO_4 , PbSO_4 , the remainder being calculated as Na_2SO_4 ; or by adding ammonia and ammonium oxalate to the aqueous solution of a known weight, and estimation of the residue left on evaporation of the filtrate and ignition with SO_4H_2 : on subtraction from this of the amounts due to MgSO_4 , NaCl , and NaHSO_4 , the Na_2SO_4 is directly ascertained.

The writer has obtained very concordant results by either of these plans, viz., estimation of Na_2SO_4 by difference, by determination of total SO_4 present, or by determination of total Na present. The total "available sulphate of soda" is known by adding $\frac{71}{120}$ of the NaHSO_4 to the amount of Na_2SO_4 found.

II.—Black-ash is rarely sold as such, being generally converted into soda-ash on the spot where it is made. Commercially, the only valuable ingredient is the sodium carbonate, the amount of which is generally determined by lixiviation of a known weight of black-ash, and titration by normal test acid of the liquor obtained. In manufacturing establishments it is frequently the practice to lixiviate the ash with water at some definite temperature, considered to be about the average temperature of the lixiviating vats; the liquor so obtained is examined (a) for alkali, determined by test acid; (b) for sodium sulphate, generally estimated roughly, but with sufficient nearness for manufacturing purposes, by addition of a standard barium chloride solution to a portion of the acidulated lixiviate, till no further precipitate is thrown down; (c) for sulphide, estimated by passing chlorine through the alkaline lixiviate till all sulphide is destroyed; boiling with hydrochloric acid, and volumetric determination of the sulphate as before, the increased amount representing the sulphide. Prizes are frequently given to those workmen who produce black-ash containing but little sulphate, showing a nearly complete decomposition of the salt-cake employed; and occasionally prizes are given when the sulphate after oxidation is low in amount, it being supposed that this indicates that over-roasting of the black-ash has not occurred. A slight misapprehension, however, usually attends this mode of analysis; although an over-roasted black-ash will yield a perceptible quantity of sulphide when treated with nearly absolute alcohol, yet the fact of an aqueous solution containing sulphide by no means proves that the ash was over-roasted, inasmuch as

on addition of water to black-ash there is always a mutual reaction between the CaS , and Na_2CO_3 contained therein; the amount of Na_2S formed therein, as the researches of M. Kolb have shown,* depends on the temperature and dilution of the liquid, and the time employed; and accordingly it is often found that the sulphide existing in the black-ash lye from the vats is very different in amount from that calculated from the laboratory analyses of the black-ash worked. The laboratory test for "sulphate after oxidation," therefore, is really useless, as it neither denotes the quality of work done by the furnace-man nor that of the black-ash lye.

The writer has shown in a recent paper (*Chem. Soc. Journ.*, xx., 407) that there is contained in ordinary black-ash a sodium compound insoluble in hot water even on long digestion, but decomposable by long continued boiling. In cases, therefore, where the total "available alkali is to be exactly determined, either this long boiling must be performed, or the total sodium present must be determined gravimetrically, and that contained as chloride and sulphate subtracted; in either case a tedious operation. The same applies in the case of the analysis of the lixiviated black-ash, or vat-waste. Ordinarily the vat-waste is examined by lixiviating or washing on a filter a known weight of waste fresh from the vats, or previously completely dried. In either case a considerable amount of calcium hydric sulphide comes into solution, and hence if the solution so obtained be immediately titrated with test-acid, more soda is indicated as present than really has been dissolved out. By passing CO_2 through the solution till H_2S is completely expelled, boiling to decompose calcium bicarbonate, and filtration from the precipitated calcium carbonate, this error is avoided. The same effect is produced by adding ammonium carbonate to the solution and boiling in a flask till no further evolution of ammoniacal gases takes place; but in either case the sodium contained in the insoluble compound, or as sulphate (found by oxidation of calcium sulphide and subsequent reaction on the sodium carbonate, especially if the waste have been previously dried), remains unestimated. When accuracy is required, therefore, a gravimetric determination of sodium is unavoidable.

In cases where an accurate analysis of the total contents of a sample of black-ash is required, the following method gives reliable results tolerably speedily. Most of the modes of determination are likewise applicable to samples of dry vat-waste:—

(a). A known weight is dissolved in hydrochloric acid, the insoluble coke and sand collected on a weighed filter, and the carbon subsequently burnt off.

(b). In the filtrate from (a) the SO_4 is estimated by precipitation by barium chloride and weighing the BaSO_4 .

(c). A known weight is dissolved in nitric acid, and the Cl determined volumetrically by a standard silver solution.

(d). A known weight is treated in Mohr's CO_2 apparatus; the ammonium carbonate found precipitated by boiling with calcium chloride; the precipitate washed till the washings are neutral, dissolved in a slight excess of standard hydrochloric acid, and the excess determined by a standard alkaline solution; thus the CO_3 can be calculated.

(e). A known weight is fused with four times its weight of a mixture of three parts dry sodium carbonate and one of potassium nitrate (both free from sulphate). From the total sulphate thus formed, and estimated gravimetrically by barium, that existing as Na_2SO_4 is subtracted, and the remainder calculated as S.

(f). A known weight is treated with hydrochloric acid, the filtrate oxidized by nitric acid, and the mixed $\text{Fe}_2\text{O}_3\text{Al}_2\text{O}_3$ and P_2O_5 precipitated by ammonia.

(g). The filtrate from (f) is treated with ammonium oxalate, the precipitate estimated volumetrically by per-

manganate, or gravimetrically as CaCO_3 ; hence the Ca known.

(h). A known weight is lixiviated with warm water, and in the filtrate from the insoluble matter the SiO_3 estimated by evaporation to dryness with hydrochloric acid; in the filtrate from this the Al_2O_4 combined as aluminate is determined by precipitating the alumina by ammonia.

(i). A known weight is cautiously treated with sulphuric acid in a capacious platinum crucible, and heated till gases cease to be evolved; the residue is treated with water, filtered and well washed, ammonia and ammonium oxalate added to the filtrate; and ultimately the total Na contained weighed as Na_2SO_4 .

In calculating results from the foregoing data, the Cl found is calculated as NaCl, the SO_4 as Na_2SO_4 , the SiO_3 as Na_2SiO_3 , and the Al_2O_4 (soluble in water) as $\text{Na}_2\text{Al}_2\text{O}_4$; the remaining sodium is then calculated as Na_2CO_3 , and the remaining CO_3 as CaCO_3 . The sulphur is calculated as CaS, and the remaining calcium as CaO. From the total $\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3 + \text{P}_2\text{O}_5$ the alumina present as aluminate is subtracted; the coke and sand, &c., are directly determined (a). The difference from 100 in a carefully conducted analysis will not amount to more than a few tenths per cent, and represents cyanogen, traces of moisture, &c., and loss.

In an over-roasted ash the alkaline sulphide can only be safely estimated by digestion with nearly absolute alcohol, oxidation to sulphate by chlorine, and precipitation by barium. The Na contained as poly, or mono, sulphide, may be determined volumetrically by test acid in the alcoholic solution, and must be subtracted from that to be calculated as Na_2CO_3 as above: the S existing as poly, or mono, sulphide of sodium must be subtracted from the total sulphur found, the difference being calculated as CaS.

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

DOUBTLESS the majority of your readers imagine (if they ever took the trouble to think of the matter at all, which is not very likely) that the paths of a "special correspondent" are strewn with flowers. What has he to do but to examine, compare, and write the results in as decent English as he can command? This is very true; but has it never struck you, "gentle reader," that there is, to put it mildly, a tinge of sameness about all this examining, comparing, and writing? Your correspondent would not have alluded to the subject were it not that he has fallen a victim to another set of "*concessionnaires*." As long as one could take a chair outside the building and refresh oneself with a cup of coffee after the fatigues necessarily involved in the study of the productions of rival blacking and soda-water manufacturers, one's task was, although laborious, not without its redeeming points; but now that the chairs are removed, you must no longer expect the same regularity from your correspondent.

Our French friends here are in high glee about the Newton-Pascal affair. It will, indeed, need overwhelming evidence to disprove the mass of forged documents upon which the advocates of the Pascal theory rely. Unfortunately, the evil does not rest here. In this city there are a number of clever and not too scrupulous men of letters who delight beyond measure in mystifications of the Newton-Pascal type. Any great event in scientific, political, or artistic history is at once seized upon as a theme, and on it are erected a variety of literary edifices which, if not sound, are at least showy and attractive. To prove this it is only necessary to allude to the mass of forged letters of Marie Antoinette, upon which such opposite theories have been built. The affair of the necklace, the Man in the Iron Mask, Count Cagliostro, the Count

* *Annales de Chimie et Physique*, June, 1866.—Vide *CHEMICAL NEWS*, Nos. 345—347.

de Saint Germain, Madame de Brinvilliers,—I could for a thousand francs obtain documents to prove any theory connected with these highly promising subjects for the skill and inventiveness of literary charlatans. At a discussion the other day upon the affair of Newton, a French literary celebrity, pressed rather hard on the question of these forgeries, stated, with the entire concurrence of the Gallic element among his hearers, that France would soon prove to the world that *all* the greatest discoveries and the grandest ideas were French. "Your English writers, what are they but imitators of us? You have invented the word "adapted" to conceal your robberies from our dramatists, and now, not satisfied with "adapting" our dramas, you "adapt" our discoveries. Your Swift and your Sterne that you pride yourselves upon so much, have they not robbed from Rabelais? They should be kicked, especially your Sternes." The roar of laughter that arose from the English portion of his hearers so disconcerted the worthy professor, that "the sitting was suspended" for some minutes; but he enjoyed the explanation which followed so thoroughly that harmony was immediately restored.

To return to our work. Messrs. Burgoyne, Burbidges, and Squire, of Coleman-street, London, have a very handsome and well-arranged collection of drugs and chemicals. They are of very fine quality. They exhibit oil of bitter almonds both in the raw state and as freed from hydrocyanic acid. Their oils of cloves, carraway, pimento, nutmegs, cubebs, pepper, &c., are apparently as good as they can be. They, like the Messrs. Howard's, exhibit a fine specimen of benzoic acid; it is in a large globe, and has a very good effect. It is not made by direct sublimation, but by boiling the powdered gum benjamin with lime and water as long as any acid remains to be extracted. The solution is then precipitated with hydrochloric acid, and the resulting benzoic acid, after being separated by filtration from the solution of chloride of calcium, is dried and sublimed. They also exhibit white crystallised benzoic acid, prepared entirely by the wet process. This kind of acid is used in Germany, and is manufactured entirely for that market. Their cyanide of potassium, prepared by Liebig's process, looks well, and is stated by the makers to contain a very high percentage of pure cyanide. There is a sample of pure nitrate of barium, which they are now manufacturing in large quantities at the price of from £35 to £40 per ton. The chloride of barium is also manufactured by this firm in a pure state at £30 the ton. They also exhibit nitrate and carbonate of bismuth perfectly free from arsenic; and potassio-tartrate of antimony in crystals and in powder. The cubebin shown is prepared from the residue left in the still after distilling oil of cubebs. There are in this case two large specimens, about sixteen inches in diameter, of piperin and caffeine. Piperin forms a very easily-broken crystalline mass, and the most extreme care had to be taken to get this fine preparation safely to the Exhibition. It was suspended by india-rubber springs so as to avoid concussion, and the arrangement was then hung in gimbals like a ship's compass. Owing to this careful packing it arrived safely, and without the mass losing a single crystal.

When we think how many fine specimens, not only chemicals, but also works of art, were destroyed in transit (some by careless packing, and still more by the brutally rough usage the packages containing them received), we cannot help expressing the hope that the skill and care shown in this matter by Messrs. Burgoyne and Co. will be imitated in future by some of those exhibitors whose despair, on unpacking their cases, was so ludicrously displayed.

The very complete collection of the scale preparations of iron exhibited in this case have suffered from the prolonged exposure to light which they have necessarily undergone, and have thus lost that beautiful colour and brilliant lustre which they possessed when they first arrived.

Among the other objects interesting to Pharmacutists, are a collection of gelatine capsules containing balsam of copaiba, castor oil, oil of male fern, and sundry other unsavoury drugs. The exhibitors were induced to undertake the manufacture of these articles owing to the low character of a vast number of the capsuled preparations found in commerce. It is well known to those behind the scenes in these matters that, owing to the viscosity of the balsam of copaiba and oil of male fern, it is a common practice among unscrupulous makers to thin them down with linseed oil in order to facilitate the process of filling the capsules. The dilution of the active ingredients of the capsules which thus takes place is often so great as to render them entirely valueless as medicines.

Messrs. Burgoyne's case is one of the handsomest and best arranged in the English chemical department of the Exhibition, and, if it contains no great novelties, at least represents in a highly creditable manner the present state of English Pharmaceutical manufactures.

Messrs. Davy, Yates, and Routledge, of Upper Thames Street, London, have also an excellent display of drugs and chemicals. Their specimen of corrosive sublimate in a dome is adapted to show the fracture, and looks well. They also show calomel in a crystalline form as prepared by the old dry sublimation process, and also as sublimed in presence of steam. The first kind becomes discoloured on exposure to light, and sometimes retains traces of corrosive sublimate; the second is free from either of these defects. The ammonio citrate of bismuth is a comparatively new scale preparation. It is in the form of micaceous scales, containing sixty per cent of oxide of bismuth. The fact of its ready solubility in water without decomposition, and its being "compatible" with the alkalies and their carbonates, has made this salt a great favourite with many practitioners; and, indeed, in some stomach complaints this and other preparations of bismuth appear to act almost like a charm.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, SEPT. 18, 1867.

Anti-incrustator for Steam Boilers.—Gifford's Monster Balloon.—Prize Subjects of the Haarlem Society of Sciences.—Fluorine Compounds, Isolation of Fluorine.—Potato Disease.—Preservation of Anatomical Specimens.—Report on Unity of Weights and Measures.

M. E. Schmitz exhibits an anti-incrustator for a steam boiler, composed of small surfaced curved blades, placed in contact one with the other in the same manner as curved tiles on the ridge of a house roof, in such a way that their *ensemble* forms a sort of double bottom in the boiler and in the generators. This double bottom only leaves a thin layer of water, of unequal thickness, absorbing the caloric, in consequence, under unequal conditions. The result is that the liquid particles are put rapidly in motion according to the difference of densities produced by the heat. The direction of the motion is transversal, and the circulation is caused to move upwards; on one side the steam, as soon as it is formed, while on the opposite side the water, less hot, descends to be vaporised in its turn. This circulation, which is very rapid and continuous, produces effects which annihilate completely the two causes of destruction.

The velocity of the liquid current is propagated throughout its entire mass, and determines a sort of molecular rolling which tends to take up the heat transmitted by the heated surface of the boiler, as quickly as it is formed. The liquid mass thus becomes the regulator of the heating of the metallic envelope which contains it, and, consequently, diminishes the causes of unequal dilations. By its rapidity, the current does not allow any matter to adhere to the surface of the boiler, and carries all impurities to the surface of the water,

where the steam is separated without peturbation. Thus the deposit takes place on the inner surface of the double bottom, and as there is always a current of water in contact with the bottom of the boiler, it can never get red hot. By the anticrustator of M. Schmidt the risk of explosion is considerably reduced.

The great news of the day is the inauguration on the 7th inst. of the anchored balloon of M. Henry Giffard, the celebrated inventor of the injector for steam engines. He has spent more than £4,000 upon the realisation of the greatest experiment of modern times. Having rented a plot of ground adjoining the extensive engine factory and machine works of M. Henry Flaud, he has erected an immense cylindrical screen of canvass fixed upon vertical poles. In this he has constructed a balloon 69 feet in diameter, holding 210,000 cubic feet of gas, formed of two webs of closely woven linen, cemented together by several layers of American black india-rubber varnish, the whole being covered with drying oil so as to prevent any of the effects of osmose or diffusion. Two series of gigantic apparatus have been constructed on the same spot, for the production of pure hydrogen. The first is composed of 100 barrels, each containing 155 lbs. of dilute sulphuric acid, with a large quantity of iron turnings capable of furnishing, each, 350 to 400 cubic metres of gas. The second apparatus is a steam generator, by aid of which the steam is decomposed, by passing over red-hot charcoal or incandescent coke, into pure hydrogen and carbonic acid gas; the hydrogen is separated from the mixture by the aid of quick lime, which absorbs the carbonic acid gas and leaves the hydrogen pure, dry, and cool, to be conducted by a main pipe to the upper part of balloon. With this second series the hydrogen only costs two-pence per mètre cube (or about 4s. 9d. per 1,000ft.) but the preparations are not quite completed; in a trail on the 9th inst. the balloon was inflated with hydrogen resulting from the action of sulphuric acid, and the operation was finished in 8 hours, whereas the filling of the balloon with gas procured by the decomposition of water took 48 hours. The former process gave also 3,500 cubic feet of mother-water of sulphate of iron, collected in a vast subterranean basin, which can be sold to be evaporated by chemical manufactures, and which are sufficient to disinfect the cesspools of a whole quarter of Paris. Inflated on Saturday, the balloon had lost almost nothing of its gas on Monday, and on Thursday the 12th, when we visited it, the total loss of hydrogen was only 2,100 cubic feet, or a hundredth part of the total volume of gas with which the balloon had been inflated. The osmose or the diffusion is really prevented. The closing of the upper and lower valves, ingenious beyond description, is absolutely hermetic. We need scarcely remind our readers that the cable, 984 feet long, by which the balloon is attached to the earth, is coiled and uncoiled by two different steam engines, which the mechanic can stop or set at work at will by means of cocks which serve for the distribution of the steam.

The inflation being terminated, the balloon, containing 210,000 cubic feet of hydrogen gas, was retained by the ballast; at each of the 70 ropes of the group were attached ten sand bags weighing each 33 lbs.; and in spite of this weight of 22,100 lbs. the car was more than 3 feet from the ground, so great was the ascensional force. A rather strong wind, that may be estimated at 33 feet per second, was then blowing but it did not prevent the balloon from rising in a vertical direction. These experiments, suspended for some days, were to have been renewed on Saturday last. This organisation of a view of Paris from a height of 984 ft. reflects great credit on M. Giffard.

The Dutch Society of Sciences of Haarlem proposes for public competition the following subjects, the essays on which are to be deposited before the 1st January, 1869:—1. Profound researches on the nature of the infecting principle of the contagious typhus of cattle, indicating at the same time the prophylactic methods,

the employment of which proceeds rationally from the result of these investigations. On account of the great importance attached to the solution of this first question by the Society, an extraordinary premium of five hundred florins will be added to the gold medal. 2. Detailed examination of the different substances composing the liquid produce of the dry distillation of coal. 3. The experiments of Mr. Tyndall have demonstrated that the intensity of sound differs considerably according as it is propagated in hydrogen or in atmospheric air, even when the densities of the two gases are equal; the Society demands, on this subject, comparative experiments made with at least three different simple gases. 4. To decide experimentally if the radicular extremities of plants exude matters capable of dissolving the silicic acid which is found in the ground in the shape of quartz. 5. New researches on the mutual decomposition of saline solutions containing different bases and acids which decide between the doctrine of affinities and that of Bergmann. 6. Ulterior exact researches on the remarkable phenomena of dissociation discovered by M. Sainte-Claire-Deville.

The chemical event of the last month has been the forwarding by M. Dumas, to the Academy of Sciences, of the researches of Mr. Prat on the chemical constitution of fluorine compounds and the separation of the fluorine. Mr. Prat started from this fact that the fluorides are really oxyfluorides; that the fluoride of calcium, for example, is formed of two equivalents of calcium, one of oxygen, one of fluorine, and that, in consequence, the true equivalent of fluorine is 29.5, and not 19, and that, in order to obtain it, all that is necessary is to treat the fluoride of calcium with chlorate of potassium, or, what is better, perchlorate of potassium, for it is only with this last salt that the reaction takes place. Oxygen is disengaged and a gas is produced which silver absorbs, giving rise to a fluoride of silver, insoluble in water, soluble in ammonia, from which it is precipitated by nitric acid, and which is altered by the action of light more rapidly than the chloride of silver; the formula of the real chloride is AgFl , whilst that of the soluble fluoride of chemists is AgFl_2O . Fluorine is obtained by heating, in a platinum retort, fluoride of lead of the chemists one part, either with nitre five parts, or with binocide of manganese two parts. Oxygen gas and fluorine are disengaged, the oxygen is taken up in its passage by fragments of heated baryta. Fluorine is gaseous, nearly colourless, possessing an odour like chlorine, very visibly giving off fumes in the air, combustible, and heavier than air; it dissolves indigo, redens and discolours litmus paper, disengages fumes in contact with ammonia, decomposes water at the ordinary temperature, combines with hydrogen under the influence of diffused light, and eliminates bromine and iodine from their compounds; it unites with boron, silicium, and all the metals of the first five groups.

MM. Juette and Ponteves have succeeded in preparing tartaric acid from the skins of grapes, after they have been pressed and distilled, and can be put to no use but as manure. After distillation the skins are treated with water so as to obtain lees, to which is added 2 per cent of sulphuric acid, and the mixture is boiled for some hours. The tartaric acid in combination is set at liberty, and, moreover, not only the sugar escaped from the fermentation is not eliminated, but the action of the sulphuric acid on the cellulose of the pulp of the grape forms a certain quantity of glucose. The liquor is allowed to ferment, and a supplementary distillation gives again an appreciable quantity of alcohol. When the decantation has been made, lime-wash is added, and tartrate of lime is produced, from which the tartaric acid is extracted by the ordinary method. According to the inventors the quantity of grape skins left after 1 million hectolitres of wine, treated by this process, would give 200,000 kilogrammes of tartaric acid the value of which is about 600,000 francs. (£24,000).

The Marquis de Havrincourt has addressed to the *Courier de Pas de Calais* the following letter: "M. Georges Ville, by following his very ingenious method of examining the vegetation of plants themselves, has just discovered the cause of the potato disease. The cryptogamia are the result and not the cause of the malady. Let any one go to the experimental grounds of Vincennes and he will be convinced as I have been. He will see there a plot of potatoes divided into five parts touching each other: the first is luxuriant and has not a sick leaf, the second is attacked by the malady; the third as the first; the fourth is as diseased as the second; and the fifth resembles the first and third. Thus M. Georges Ville produces or avoids the potatoe disease at will."

The following is the process of M. Von Vetter for the preservation of anatomical specimens:—Add to 7 parts of glycerine at 22° one part of raw brown sugar, and half a part of nitre till a slight deposit is formed at the bottom of the vessel. The portion required to be preserved is then plunged, dried or not dried, and it is left in the mixture for a time proportional to its dimensions; a hand, for example should remain eight days in the liquid; when it is taken out it is as stiff as a piece of wood, but if it be suspended in a dry and warm place the muscles and articulation recover their suppleness.

M. Jacobi has just issued his report on the Unity of Weights and Measures, drawn up in the name of the Commission of Moneys, &c., of the Exhibition.

On summing up, the commission think that the governments ought to keep the following objects in view:—The substitution, as soon as possible, but integrally, of the metric system as is practised in the west of Europe and in many other countries, in place of the old systems of weights and measures. This system introduced at once, and rendered legal but optional, cannot be rendered obligatory at first. The period of toleration varies with the state of the different people, their degree of instruction, &c., and it can only be determined by the governments. It has been remarked, however, that a too long delay does not perceptibly aid the governments in the accomplishment of their task. At all events, it is desirable that governments should take, henceforth, some necessary measures, which are—first, to order the study of the metric system in all schools, and to require a knowledge of it in public examinations; secondly, to introduce its exclusive use in scientific publications, public statistics, in post-offices, custom-houses, public works, and any other branches of the administration that the governments may deem convenient. The commission does not consider that it is part of its mission to occupy itself with the making of standards, exact copies of the prototypes of Paris, the possession of which, in a practical point of view, is the indispensable preliminary of every metrical reform. The administration of each country will appreciate the degree of exactitude suitable to the different destinations of these standards.

F. MOIGNO.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

SEPT. 9, 1867.

(FROM OUR OWN CORRESPONDENT.)

The Pascal-Newton Forgeries.—New Compounds of Cyanide of Amyl.—Polarisation of Electrodes.

LET me say a few words on the answers of M. Chasles to the objections urged by M. Faugère, which had some appearance of gravity. The first was the allusion made in one of the letters written by Pascal, in 1652, about coffee and the froth of coffee. "Coffee," he said, "was not introduced into Parisian society before 1609, about

seven years after the death of Pascal." Thus, without going further, M. Chasles finds in the Dictionary of Bouillet that coffee was drank in Venice in 1615, and at Marseilles in 1654; and in the new curious treatises on coffee, tea, and chocolate, published by Philip Sylvestre Dufour, in 1684, we find "coffee has not been known in France for more than forty years." Subtracting these, forty from 1684 we have 1644. Pascal, young, well acquainted with the world, and ardent in the advancement of progress, would not have been the last to have known the existence of coffee. Moreover, a forger, while treating on universal gravitation, would not have dreamt of connecting it with the froth of coffee.

To the second objection of the improbability of a correspondence between Pascal and Newton while children, as M. de Morgan and Sir David Brewster remark that he never knew French otherwise than with a dictionary, M. Chasles answers by presenting striking documents.

"PASCAL TO WALLIS.

"This 29th August, *apropos* of this young student (Newton), can you give me some tidings of him, and principally about his arrangements. Some friends assured me that the letters written by him to me, and the questions that he has submitted seem to have rather come from his professor than from him. I should like very much to have correct information. Perhaps you can give me a word about it? I am waiting for your reply."

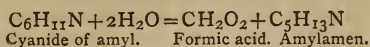
"DESMATZEAUX TO FONTENELLE.

"October 20, 1727.—This one (the Professor) advised his young pupil to write a letter to Pascal, and to submit to him some geometric questions or problems to be solved. It is the best way, said he, to obtain an answer. The letter was then prepared in concert with the Professor, as well as the questions, and sent by young Newton, yet a student, to M. Pascal. The latter finding, without doubt, the letter and questions extraordinary for a child, and recollecting, perhaps, that he himself had been a precocious child, ardent to learn, searching everywhere to instruct himself, replied to the young Newton. It was was thus that relations sprang up between the two men of genius, which lasted till the death of Pascal. I am perfectly sure that young Newton took part in it. It could not be otherwise. However, 'M. Le Chevalier Newton' has avowed it to me himself, that it was these relations which engaged him to follow a scientific career."

Little satisfied with the peremptory answers of M. Chasles, M. Faugère returned to the charge and answered one by one his arguments without signification, insisting, above all, on the verification of the writing. Now, M. Chasles declared that he is ready to accompany him to the Imperial Library, in presence of the members of the Commission and the Academy who would wish to take part in it.

At the last meeting M. Dumas transmitted a second letter from Dr. A. W. Hofmann on a new compound of cyanide of amyl analogous to hydrocyanic acid. By pouring gradually a mixture of an alcoholic solution of ethylamine and chloroform into a retort containing pulverised hydrate of potash, a most energetic reaction takes place; the mixture becomes heated to the boiling point, and a liquid distils over, the penetrating odour of which surpasses all that can possibly be imagined. The liquid is the cyanide of amyl, transparent, colourless, lighter than water, insoluble in water, soluble in alcohol and ether, possessing an insufferable odour something like that of amyaceous alcohol and hydrocyanic acid. Its vapour possesses, in a higher degree than that of cyanide of phenyl, the property of leaving an intensely bitter taste on the tongue, and a suffocating feeling in the throat similar to that produced by prussic acid. It can be distilled without decomposition, and boils at 137°C. But little attacked by alkalis, it is decomposed by acids, with an almost explosive violence; a slight ebullition in pre-

sence of acidulated water is sufficient to transform it into formic acid and amylamen.



At present M. Balard, by virtue of a note inserted in the *Comptes Rendus*, and the *Treatise on Chemistry*, of M. Naquet, claims the discovery of this new analogue of cyanhydric acid in favour of M. Armand Gauthier, laboratory pupil of M. Wurtz.

M. Gauguain presented a note on the polarisation of electrodes. Several savants have sought to determine the part which each of the electrodes takes in the polarisation, and have arrived at different results: M. Poggendorff found that the two electrodes contributed equally to the production of the electromotive force developed; MM. Lenz and Sawelgew found on the contrary that the part of the cathode is greater than that of the anode. M. Gauguain tried in his turn to resolve the question by making use, as he did on former occasions, of the *method of opposition*, and the following are the dispositions he adopted. In a cylindrical glass vase he placed a porous cylinder of much smaller diameter, and both vessels were filled with the same liquid. The strips of platinum which are to serve for the decomposition of the liquid are placed in the exterior vase, and a third plate of metal is introduced into the porous cylinder; this third plate, which remains constantly out of the circuit, traversed by the current, does not experience any polarisation, and can be successively compared with each of the electrodes when these are polarised to saturation; this comparison gives the measure of the two polarisations of the anode and the cathode. The porous diaphragm serves to keep the neutral plate out of reach of the influence of the hydrogen disengaged by the electrolysis.

The following are the results thus obtained by a series of experiments carried on with a mixture of nine parts by volume of distilled water, and one part of sulphuric acid.

Polarisation of the anode	193
" of the cathode	157
Total polarisation	352

It appears to be of little consequence, if more or less sulphuric acid be added to the electrolysed water, provided that this proportion does not fall below a certain limit; but when it becomes extremely small the polarisation of the cathode increases without the polarisation of the anode being sensibly modified. The following are the results obtained by electrolysing pure water:—

Polarisation of the anode	193
" " cathode	243
Total polarisation	434

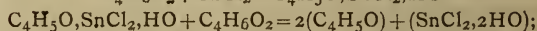
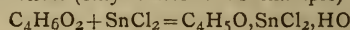
M. Matteucci recently (*Comptes Rendus*, Jan. 14, 1867) called the attention of the Academy to an experiment which he had made in 1838, and upon which he depended to prove that the polarisation proceeded from the gases adherent to the electrodes. In fact, polarised metals should be considered as fugitive combinations formed by the metals and gases, and the author is of opinion that in couples of polarisation as well as in Grove's gas pile, the electromotive force is the affinity exerted on one of the elements of the water by a gas associated in a particular manner to a metal.

The Magnesium Light.—We understand that this light is likely to play an important part in the Abyssinian expedition. Mr. Mellor, the manager of the Magnesium Metal Company, is prepared to supply several hundred-weights of the powdered metal; and the authorities at Chatham have been for some time experimenting on the subject.

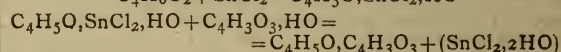
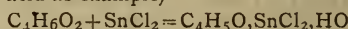
CHEMICAL NOTICES FROM FOREIGN SOURCES.

Ethers, Contribution to the History of.—Ch. Girard and P. Chapoteaut. If one equivalent of alcohol is mixed with one equivalent of stannic chloride, and rise of temperature has been guarded against, crystalline compounds are formed which are volatile almost without decomposition; they dissolve in water, and then decompose gradually, forming alcohol, chloride of alcohol-radical and stannic oxychloride. Heated with one equivalent of an alcohol they form ether and chloride of the alcohol employed, besides stannic oxide, and chloride. The formula of the ethyl-compound is $\text{C}_4\text{H}_5\text{O}, \text{SnCl}_2$. Alcalic hydrates decompose them into alcohol and stannic oxide, and boiling alcohol into ordinary or mixed ether. These reactions show that the part taken by stannic chloride in the formation of ether is similar to that of sulphuric acid, and this is still more apparent if the action of stannic chloride on mixtures of acids and alcohols is considered; in this case the compound of alcohol and stannic chloride, originally formed, acts upon the acid and produces by mutual decomposition the mixed ether. The authors have in this way prepared the methylic, ethylic, and amylic ethers of formic, acetic, tartaric, lactic, butyric, benzoic, palmitic, and stearic acid. The action of stannic chloride is explained in the following equations.

1. On alcohols (ethylic alcohol as example)



2. On a mixture of alcohol and acid (ethylic alcohol and acetic acid as example)



(*Comptes R.* lxiv. 1252.)

Synthesis of Methylallyle.—A. Wurtz. It has been shown by the author, some years ago, that the action of zinc ethide upon allylic iodide gives rise to the formation of ethylallyle = $\frac{\text{C}_3\text{H}_5}{\text{C}_2\text{H}_5}$ which is isomeric with amylene.

Zinc ethide and brominated propylene scarcely act upon each other, either in the cold or at an elevated temperature; nor do zincic methide and allylic iodide. But if, in the latter case sodium be added and the temperature raised to 120°, an energetic reaction takes place, in course of which a very volatile hydrocarbon is formed, which, combined with hydriodic acid, has the composition $\text{C}_4\text{H}_8, \text{HI}$. A more ready method to obtain this body is the following: A mixture of methylic and allylic iodide, diluted with twice its volume of dry ether, is heated together with sodium to 100° for several hours in sealed vessels. After the completion of the reaction, the contents of the vessels are distilled, the distillate saturated with bromine, the excess of the latter removed by potassic hydrate, and again distilled. When all the ether has gone over, the distillation is continued in a vacuum and stopped when the temperature reaches 100°. The residue solidifies on cooling and consists of diallylic tetra-bromide, the portion distilled off is subjected to repeated fractional distillations, and finally a colourless bromide is obtained. This bromide is readily decomposed by sodium and the hydrocarbon $\text{C}_4\text{H}_8 = \frac{\text{C}_3\text{H}_5}{\text{C}_2\text{H}_5}$ formed which is a gas at ordinary temperatures, but may be condensed to a liquid by being cooled to -12°; it then boils between -4° and +8°.

The hydriodate of methylallyle boils between 116° and 118°. Butylenic hydriodate, although of the same boiling-point and sp. gr., is not considered by the author to be identical with the former, on account of the hydrocarbon having a considerably lower boiling-point.—(*Comptes R.* lxiv. 1088.)

CORRESPONDENCE.

GAS FROM IRON.

To the Editor of the Chemical News.

SIR,—In the valuable article of Dr. E. G. Tosh, "On the Analysis of Cast Iron" (vol. xvi. p. 34), mention is made of the observation of Schnitzler that in Weyl's process for the estimation of the carbon, bubbles of gas are evolved from the metal during solution. Rather than entirely accept the explanation proposed by the author, or entertain that of Schnitzler, I am more inclined to venture to draw attention to another possible explanation. I have noticed that under similar circumstances, gas is disengaged from thin iron wire, and it struck me as being the natural gas occluded by the metal. May it not be so with the cast iron? In the *Journal Chem. Soc.* (vol. v. p. 287), Graham states wrought iron probably carries about 6 or 8 times its volume of occluded carbonic oxide, and as much as 12.55 volumes of natural gas have been extracted; now according to this 4 grains cast iron, say of 7.5 sp. gr., might contain from 3.18 c.c. to 4.24 c.c. or even as much as 6.36 c.c. of a mixture of hydrogen and carbonic oxide, the former varying in the proportions of 21 to 35 per cent, that is, supposing cast iron to occlude gases in the same way as wrought, which I believe has not yet been shown, and from its crystalline nature might not be anticipated. Nevertheless we find that white variety of cast iron is of a pasty consistence when fused, and the grey iron is always of a porous nature, conditions which lead one to expect them to have the property of occlusion; further, Deville has extracted carbonic oxide from a cast steel tube. The gas which escapes during electrolytic solution has a peculiar odour, so also has that naturally occluded by malleable iron.—I am, &c.

WALTER NOEL HARTLEY, F.C.S.

September 3, 1867.

BAKING POWDERS.

To the Editor of the Chemical News.

SIR,—In a recent number of the CHEMICAL NEWS you published some remarks on the above subject from your Paris correspondent; the paragraph was copied into various journals, and as the remarks referred to are calculated to mislead the public, perhaps you will allow me to say a few words on the subject.

The question as regards "baking powders" does not relate to their composition so much as to their excessive use as a substitute for more proper ingredients; carbonate of soda, tartaric acid, and a small proportion of rice-flour, which form the compound, are so inexpensive that there is no temptation to the manufacturer to employ inferior or cheaper articles, if even they could be found. There exists, therefore, no necessity for those prominent warnings, which are continually published, against "imitations," of certain baking powders; but the public need guarding against the belief, that these powders can adequately supply the place of butter and eggs in pastry and puddings.

Baking powders may be perfectly genuine and proper as far as they go, but they must be pernicious to health if used habitually as a substitute for the nutritious elements which ought to have a place in articles of daily food.

The sum total of the matter is this, that baking powder may be perfectly genuine and harmless in themselves, but they become injurious to health if employed to adulterate food into which they are introduced.

I do not deny that a small porportion of baking powder may be used with advantage in pastry in addition to the usual ingredients, but not as a substitute for any of them; and this is all that can be said in favour of the compound.—I am, &c.

SANITAS.

September, 1867.

MISCELLANEOUS.

In Memoriam.—Faraday.—In his introductory address to Section A of the British Association, the President, Sir William Thomson, said:—It was my intention not to detain you from the interesting subjects and abundant matter for discussion which will so fully occupy our time during the meeting, by an introductory address; but I must ask you to bear with me if I modify somewhat this resolution, in consequence of a recent event, which, I am sure, must touch very nearly the hearts of all present, and of very many in all parts of the world, to whom the name of Faraday has become a household word for all that is admirable in scientific genius. I wish I could put in words something of the image which the name of Faraday always suggests to my mind. Kindliness and unselfishness of disposition; clearness and singleness of purpose; brevity, simplicity, and directness; sympathy with his audience or his friend; perfect natural tact and good taste; thorough cultivation—all these he had, each to a rare degree; and their influence pervaded his language and manner, whether in conversation or lecture. But all these combined made only a part of Faraday's charm. He had an indescribable quality of quickness and life. Something of the light of his genius irradiated all with a certain bright intelligence, and gave a singular charm to his manner, which was felt by every one, surely, from the deepest philosopher to the simplest child who ever had the privilege of seeing him in his home—the Royal Institution. That light is now gone from us. While thankful for having seen and felt it, we cannot but mourn our loss, and feel that whatever good things, whatever brightness, may be yet in store for us, that light we can never see again.

An American View of English Patent Law.—We quote the following from our talented contemporary, *The American Journal of Mining*. From the amusing illustration quoted in the latter part, it would appear that the American patent laws are at least as elastic as our own. "The CHEMICAL NEWS describes, with well-merited ridicule, an apparatus patented Oct, 1866, in England, for the generation of 'vital force' by the contact of 'an azote and a carbonated body.' The extract will be found in another column. The NEWS justly says, 'a more powerful satire on the present state of the patent laws we have never seen. The patent laws of England are perhaps more absurd than that of any other country. They date back to a period when it was desired to transplant into England the secrets of European manufacturers; and they were primarily intended to reward those enterprising individuals who should courageously spy out the discoveries which others had made, and then, with sudden virtue, wish to be protected in their rights to the stolen property. If we mistake not, it is still a feature of the English system, that the patentee need not claim to be the original inventor, and that foreign inventors have no rights which patentees are bound to respect. A natural consequence of this fundamental injustice is an extreme looseness in the administration of the patent laws. It is proverbial that anything can be patented in England. The governmental examination amounts to little or nothing. The records show many cases of the same inventions repeatedly patented by different parties; of patents covering only elementary principles, which have long been public property; and of preposterous bits of quackery like this "battery of vital force," receiving the sanction of parchment and the royal seal. We pride ourselves on our superior system; but is it free from similar faults in administration? It is certain that our citizens would be saved much perplexity, and our courts much vexatious business, by a stricter examination of patents in the beginning by the government officials. As an offset to the amusing instance presented by the NEWS, we might mention an American patent, obtained a year or

two ago, for preserving the bodies of deceased relatives, by subjecting them to hydraulic pressure, for the purpose of expressing all moisture! We should like to submit a body, prepared by *our* patent, to the inventor of 'vital force,' and see whether, by the application of azote and carbon, he could 'bring it to!'"

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. June 10, 1867.

BOUSSINGAULT, "On the Decomposing Action of a High Temperature on some Sulphates." PAYEN, "On the Structure and Constitution of Ligneous Fibres, followed by an Account of the Methods of manufacturing Paper from Wood." A. DE LA RIVE, "On the Electrical Condition of the Earth." J. SIMONIN, "On the Bituminous Schists of Vagnas, in the Department of Ardeche, France." CHACORNAC, "On the Periodicity of Sun Spots." P. VOLPICELLI, "On the Determination of the Poles of Bar Magnets." S. DU LUCA and J. UBALDINI, "Researches on the reciprocal Action of Sulphurous Acid and Sulphuretted Hydrogen." C. FORTHOMME, "Remarks on M. Perret's Improved Wine Fermenting Vat."

Annalen der Chemie und Pharmacie. June, 1867.

A. NAUMANN, "On the Specific Heat of Gases for equal Volumes under Constant Pressure." "On the Velocity of the Movements of Atoms." E. RUBIEN, "On Enanthylidene and Caprylidene." P. JANASCH, "On Trichlorodracrylic Acid." "On Trixylylamine." O. PEPER, "On a Chlorinated Derivative of Toluol." A. BAEYER, "On Neurine." "A Lecture Experiment demonstrating the Action of Nitric Acid on an alcoholic Solution of Propargylic Ether." C. GRAEBE, "On a new Method of Forming Methylsalicylic Acid." C. GRAEBE and O. BORN, "On Hydrophthalic Acid." C. GRAEBE and O. SCHULTZEN, "On the Behaviour of the Aromatic Acids in their Passage through the Body." "On Methoxybenzoic Acid." H. HLASIWETZ, "On the Hydrocafeic and Hydroxycoumaric Acids."

Dingler's Polytechnisches Journal. May 2, 1867.

C. SCHITZ, "On J. Lundin's Improved Regenerative Gas Furnace." "On the Caloric Value of Austrian Coals." R. WEBER, "Contributions to the Knowledge of the Manufacture of Sulphuric Acid in Lead Chambers." P. BUCHNER, "On the Estimation of Tannic Acid in Oak Bark." J. MALMEDIE, "Apparatus for Bleaching Flax Yarns." A. LIELEGG, "On the Spectrum of the Flame from Bessemer Convertors."

May 18.

G. SCHNITZER, "Analyses of Baunitz from Austria." P. BUCHNER, "On the Estimation of Tannic Acid in Oak Bark." J. C. LERNER, "On the Destruction of Wooden Brewing Utensils by Fungi." H. DUFRÈNE, "On Rousseau's Improvements in Treating Beet Juice with Lime." C. KURTZ, "On the use of Canada Oil as a Substitute for Bisulphide of Carbon in the Extraction of Oil from Seeds." J. STINDE, "On the Preparation of Spirits of Nitre." O. REINSCHE, "On Colouring Thin Sheets of Metal, and rendering Membranes, Fabrics, and Glass Iridescent." CORDURE, "A Method of obtaining Silver from Argentiferous Lead by means of Zinc." CLEMANDOT, "A new Silica Glaze for Pottery Ware." B. HOFFMANN, "Some remarks on Ozokerite."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2102. C. King, Regent Street, W., "An improvement in the preparation of chocolate and cocoa." Petition recorded.—July 17, 1867.
2410. J. G. Marshall, Leeds, "Improvements in solvent or detergent processes."—August 22, 1867.—Invention protected by the deposit of a complete specification.

2453. J. Storey and W. E. Bickerdike, Lancaster, and W. V. Wilson, Jubilee Street, Mile End, Middlesex, "A new method of bronzing metallic and other surfaces."—Petition recorded.—August 28, 1867.

NOTICES TO PROCEED.

1190. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the treatment of peat, and in the manufacture of peat charcoal, and in the machinery or apparatus employed therein."—A communication from A. Frigge, Hanover.—Petition recorded.—April 24, 1867.

1212. E. Guenin, Henrietta Street, Covent Garden, Middlesex, "Improvements in the preparation and application of mustard for curative purposes."—A communication from P. Rigolot, Paris.—April 26, 1867.

1512. J. Stenhouse, Rodney Street, Pentonville, Middlesex, and J. Duncan, West Ham, Essex, "Improvements in the treatment of animal charcoal, and in the apparatus employed therein."—May 21, 1867.

2420. W. R. Lake, Southampton Buildings, Chancery Lane, "Improvements in the manufacture of iron and steel, and apparatus employed in the said manufacture."—A communication from W. W. Blanchard, Bridport, Vermont, U.S.A.—August 23, 1867.

NOTES AND QUERIES.

Electro-magnet.—Sir,—Can any fellow-reader of the CHEMICAL NEWS tell me if there is any great disadvantage in using cast-iron instead of soft wrought iron for the core of an electro magnet? For the purpose to which I wish to apply it a little residual magnetism will do no harm.—C. LINLEY.

German Yeast.—Sir,—Can any one put me in the way of obtaining any information respecting the particulars of the manufacture of German yeast? The supply, originally obtained from the Schiedam Vats, has failed to keep pace with the demand, and I believe it is now specially prepared for the market.—F. IRELAND.

Another Specific Gravity Problem.—Sir,—Perhaps one of your obliging correspondents would point out the shortest way to solve the following:—"How much of a liquid whose s.g. is 1,000, must be added to 1,000 grain measures of a liquid whose s.g. is 1,134, to reduce its s.g. to 1,286, supposing no change to take place on mixture which would vitiate the result of the calculation, that is to say, supposing the bulk of the mixture to be the sum of the bulks of the two liquids mixed."—HENRI DU CHEMIN-CREUX.

Quinine.—Sir,—Could you, or any of the readers of your paper, oblige me by informing me "how to re-dissolve quinia, which has been precipitated in the course of manufacturing ferri citr. c. quinae, by an excess of liq. ammon. fort., in a warm solution?" An addition of more citric acid has no effect upon it.—E. S.

Aneroid.—The word *aneroid* is a contraction of *anaëroid*, derived from *anō*—air—and the *α* privativum—meaning a barometer founded on the action of the pressure of air on a tube, from which the air has been exhausted. It was first constructed by Vidi, and improved by Bourdon, whose well-known steam-gauges are on the same principle.—G. L.

Table of Densities.—Sir,—Could you inform me where I can purchase a table giving the decimal weight per cubic inch of sulphuric acid at the different specific gravities?—GEORGE K. BOWNTIFF.

Testing Cognac.—Sir,—Can you tell me whether it be possible by chemical analysis to distinguish real Cognac from spirits of wine made into so-called Cognac by the addition of "flavour de Cognac," or "essence de Cognac"?—C. CAMPBELL.

TO CORRESPONDENTS.

J. P. Shire.—Any wholesale chemist will supply you with bisulphite of soda. Be careful to get the bisulphite, not the bisulphate.

E. Ellis.—It is not our province to give the information you ask. Many so-called depilatories are to be met with in commerce, but there is risk attending their employment.

F. C. S.—1. "Watts's Dictionary," under the heading Phenol (a synonym), gives a very good account of the preparation and purification of carbolic acid. As for its properties, you cannot have a better account than that given in our own "Cattle Plague Report," published at the CHEMICAL NEWS Office. 2. Consult Bowditch's Analysis, &c., of Coal Gas, or Sugg's "Gas Manipulation."

C. Campbell.—To make permanganate of silver the two solutions must be quite saturated; the equivalents are easily calculated.

J. C. B.—The alteration is unimportant.

Tyro.—The increased temperature of the soapy water is evidently due to the friction in the process of washing, and the warmth communicated to it by the hands.

H. K. Bamber, F.C.S.—Your communication has been carefully considered, and steps will be taken to diminish the abuse likely to arise.

Communications have been received from Edwin Smith (with enclosure); D. J. O.; Abbé Moigno; Thomas Anderson; A. Scott (with enclosure); W. Hartley (with enclosure); J. Heywood (with enclosure); F. C. Calvert, F.R.S.; F. Muspratt; Harry Taylor; — Warrington; J. Turner (with enclosure); Peter Squire; G. Worsley; Jabez Hughes (with enclosure); A. Brown (with enclosure); H. Gillman (with enclosure); Edward Beanes (with enclosure); F. J. Booth; J. Mercer (with enclosure); W. Herapath, F.C.S. (with enclosure); A. Gow (with enclosure); J. C. Braithwaite (with enclosure); "Rusticus" (with enclosure); F. Ireland (with enclosure); W. B. Giles (with enclosure); J. T. Bouck (with enclosure); B. W. Gibbons (with enclosure); John Cliff (with enclosure); W. L. Lindsay; M. A. Baines (with enclosure); A. Dalziel; W. Bywater; W. Ladd; C. A. Wright; W. J. Morgan (with enclosure); Nicholson and Maul; E. A. Parnell (with enclosure); Dr. Anderson; Charles A. Wright; J. M. Kenny and Co.; A. M'Leod; E. Ellis; J. Carter Bell; W. Skey (with two enclosures); H. K. Bamber; T. Macfarlane; W. Herapath, senr.; Dr. Day; F. J. Booth; H. Merton (with enclosure); W. Hooper (with enclosure); Peter Spence (with enclosure); M. Khanikoff; C. Tomlinson, F.R.S. (with enclosure); Professor A. H. Church (with enclosure).

Books Received.—"Analysis of a Biliary Concretion, and on a new method of Preparing Biliverdin."—By Dr. Phipson, F.C.S. "The Relief of Pain by the Use of Metallic Tractors." "Catalogue of the Library of the late Dr. Richardson." "A Dictionary of Chemistry." Part xlii. "Intellectual Observer." "Experiments on the Removal of Organic and Inorganic Substances in Water."

SUPPLEMENT

TO THE

CHEMICAL NEWS.

VOL. XVI., No. 407.

ON THE ECONOMISATION OF SULPHUROUS ACID IN COPPER SMELTING.*

By PETER SPENCE, F.C.S.

It will be in the recollection of members of this Section that Lord Derby, in 1861, obtained the appointment of a committee of the House of Lords, for obtaining evidence as to the noxious vapours from chemical works, &c. That investigation, carried over many months, resulted in the passing of what is called the "Alkali Works Act," and which has been so ably and successfully carried out by my friend Dr. Angus Smith.

At the same time a large amount of evidence was taken as to the emission of sulphurous acid, and arsenious acid, from the copper smelting works at Swansea, and other parts of the country; but no legislation was adopted, because, with the exception of the writer of this paper, all the witnesses testified to there being no practicable means of suppressing the nuisance without destroying the trade.

Copper smelting as now conducted appears at first sight a very crude, but is in reality a very beautiful, chemical process. The ores used are of a heterogeneous character, chiefly iron pyrites more or less impregnated with copper, and containing besides arsenides and sulphides of various other metals, with a large mixture of quartz. The first process of the copper smelter is by calcination to separate a quantity of the sulphur and as much as possible of the arsenic; for this purpose the mixed ores are exposed to a red heat, and these bodies are dissipated into the atmosphere. When calcined the ores must still retain a portion of the sulphur, varying with its richness in copper, this sulphur playing an important part in the next operation. The calcined ores are now melted down by great heat into a fluid state, when the sulphur not dissipated unites with a portion of the iron and every trace of the copper, for which it has great affinity, and sinks to the bottom of the furnace, carrying down with it any of the precious metals which may be present. The large mass of the fluid now floating at the top is silicate of iron, and is skimmed off and thrown away as slag. The *regulus* run from the bottom of the furnace contains from 20 to 35 per cent of copper, and almost invariably 28 per cent of sulphur. The *regulus* is again calcined to throw off the sulphur, and the subsequent processes of refining take place.

I effect the saving of sulphur by calcining in long furnaces, the bed being heated from below, air being made to travel from one end of the furnace to the other over the heated ore, the air and SO₂ being passed from the furnace directly to the lead chambers, the ore being at regular intervals made to traverse in an opposite direction coming out calcined where the air enters. The calcination of *regulus* is exactly similar in both cases, the calcination is only carried to a certain point, 8 to 9 per cent of sulphur being left in both the ore and *regulus*.

This process, carried out for several years chiefly in vitriol works, is now being successfully employed by the Goole Alum Smelting Company, on a large scale as a copper smelting process. It has been in operation there for over twelve months, and at present 150 to 200 tons of mixed ores are being smelted weekly. These ores are Cornish, Swedish, Norwegian, and Spanish.

About two months ago I sent down one of my chemical assistants to superintend during a month some large working experiments, analysing the results at every stage, so that reliable data might be got. One of these experiments I append, and as it is typical of the general operations, it may safely be taken as indicating what is being done.

10½ tons Cornish ores containing 19 per cent sulphur }
13½ „ Spanish smalls „ 47 „ } Sulphur.

{ mixture } = tons.cts.qrs. lbs.
(33·3 per cent) = 8 0 0 0

This was calcined, the SO₂ going to the vitriol chamber. The result was 22 tons of calcined ore, containing 8 per cent sulphur I 15 0 0

The ore when smelted gave 2 tons 15 cwt. of regulus containing 28 per cent sulphur 0 15 1 20

The loss in sulphur dissipated is therefore . . 0 19 2 8

This regulus calcined, the SO₂ going to the vitriol chamber became 2 tons, 10 cwt., containing 9 per cent of sulphur . . . 0 4 2 20

No more sulphur can be economised, therefore the total loss of sulphur is . . . I 4 1 0

Or as under,

Sulphur economised 84·8 per cent

Sulphur lost 15·4 „

Total sulphur in ore 100·0

ON A NEW TELEGRAPHIC THERMOMETER.*

By PROFESSOR WHEATSTONE, F.R.S.

THE telegraphic thermometer which I constructed in 1843, and which is described in the report of the thirteenth meeting of the British Association, depended on the simultaneous action of two isochronous chronometer or clock movements—one at the remote station regulating the motion of a plunger in the bore of a thermometer, and the other at the near or observing station, marking, by the motion of the needle of a galvanometer, the moment at which the contact of the plunger with the mercury of the distant thermometer completed or broke the circuit. The clock movements required to be periodically wound up, and therefore the affected instrument could not be left to itself for an indefinite time. There are, however, many situations in which it might be desirable to have meteorologic indications when the instruments would not be accessible for very long periods. I have, therefore, devised a new class of telegraphic meteorometers which shall be independent of clock work, and may remain in any situation of difficult access as long as the instrument endures. This principle is applicable to all instruments which indicate by means of a revolving hand, and I have already devised its application to a Breguet's metallic thermometer, an aneroid barometer, and a hygrometer, depending on the absorption of moisture by a thin membrane. It is also applicable to a bar magnet in a fixed position, and to a variety of other indicators. The apparatus consists of two distinct instruments connected only by telegraphic wires. The first I will call the questioner (A), the second the responder (B). The questioner (A) is a rectangular box, presenting externally a circular dial face, round which are engraved the degrees both of the Fahrenheit and Centigrade thermometric scales, the former ranging from 20° below zero F. to 220° above that point, and the latter from 0° to 110° C. It shows, besides, three binding screws for the purpose of connecting the telegraphic wires, and a handle which causes the rotation

* Read before the British Association, in Section B.

* Read before the British Association, in Section A.

of the armature of a magneto-motor in the interior. This magneto-motor is similar in its construction to that employed in my alphabetic magnetic telegraph; a soft iron armature rotating before the four poles of the magnet occasions, when the circuit is completed, alternate currents of equal intensity. The box also contains a small electro magnet, which acts by means of mechanism similar to that employed in the indicator of the aforesaid telegraph, and causes the revolution of the index of the dial. The responder (B) is a cylindrical brass box, which presents on its upper surface a similar dial, with its thermometric scales and index; at its base three binding screws, corresponding to those of the questioner, are fixed for connecting the telegraphic wires; and it is furnished with a brass cover that it may be hermetically sealed when lowered in the sea or buried in the ground. Its interior contains three essentially distinct parts.—1. The metallic thermometer, which consists of a spiral ribbon of two dissimilar metals, with its hand capable of ranging through the extent of the circular thermometric scale of the dial;—2. A small electro-magnet, acting by means of a propellant on a disc, making as many steps in one rotation as there are half-degrees on the scale; 3. An axis to which is fixed a delicate spiral spring, which causes a pin to bear lightly against the hand of the thermometer however it may vary in position. The two instruments are connected by means of two telegraphic wires. The first proceeds from an earth plate at the near station, passes through the coil of the electro-motor in A, joins the coil of the small electro-magnet in B, and then proceeds to another earth plate at the distant station. The second wire is permanently connected with the first between the earth plate and the coil of the magneto-motor, and includes that of the electro-magnet in B, and its opposite end is brought close to the remote end of the first wire. The mechanism is so disposed that when the first wire is disconnected from its earth terminal it is brought into circuit with the second wire. By this arrangement, when the dial of A is brought to 0° and the handle turned, at the first moment the circuit is completed through the first wire, containing the coil of the electro-magnet in B, and the return earth. A disc is thereby caused to revolve in an opposite direction to the graduation of the scale until a pin, originally starting from 0°, comes into contact with the pin, pressing against the thermometer hand, and thereby completes the circuit of the second wire, and breaks the connection with the earth plate. At first only the electro-magnet in B is acted upon, but when the currents are diverted into the new channel both the electro-magnets act simultaneously. In consequence of the action of the electro-magnet in A, the hand of its dial passes over a space corresponding with that between 0° and that indicated by the thermometers and the hand of the dial ultimately accords with that of the distant thermometer. When the hand of the dial on A comes to rest the disc in B arrives at 0°, and a catch permits the spiral spring to unwind itself, and its pin flies to and presses against the thermometer-hand. It must be observed that instruments thus constructed are not capable of marking every possible gradation; but they may be made to indicate divisions of the scale of any required minuteness. It is advisable to limit the extent of the scale when more minute divisions are deemed necessary. The only circumstance that can affect the accuracy of the indications of the instrument is this—the pin pressing against the thermometric index displaces it a little, and causes it to assume a position about a degree in advance; but as this pressure is a constant one, the inconvenience is remedied by a slight corresponding shifting of the scale. In this class of instruments the indications are not spontaneously conveyed to the observer, but they must be asked for, and whenever this is done the indications will be immediately transmitted to him however frequently the question is put. The uses to which this telegraphic thermometer may be applied are, among others, the following:—The responder may be

placed at the top of a high mountain and left there for any length of time, while its indications may be read at any station below. Thus, if there should be no insuperable difficulties in placing the wires, the indications of a thermometer placed at the summit of Mont Blanc may be read as often as required at Chamouni. A year's hourly observations under such circumstances would no doubt be of great value. If it be required to ascertain during a long-continued period the temperature of the earth at different depths below its surface, several responders may be permanently buried at the required depths. It will not be requisite to have separate questioners for each, as the same may be applied successively to all the different wires. The responder, made perfectly water-tight, in which there would be no difficulty, might be lowered to the bottom of the sea, and its indications read at any intervals during its descent. In the present mode of making marine thermometric observations, it is necessary that the thermometer should be raised whenever a fresh observation is required to be made.

ON THE PRESENCE OF COLUMBITE IN WOLFRAM.

By T. L. PHIPSON, Ph.D., F.C.S.

I HAVE recognized the presence of columbite (niobate of iron and manganese) in a sample of wolfram from Auvergne that I have lately analysed, which was given to me some years ago by M. Pisani. I had already remarked that wolfram from different localities sometimes contained niobic acid, sometimes tantalic acid, which can be made distinctly evident by examining before the blow-pipe the residue left when most of the iron, manganese, and tungstic acid, have been separated.

From the specimen here in question I succeeded in extracting from some twenty grammes a quantity of columbite sufficient to fill a small bottle, and to enable me to study its properties easily. The separation of this rare mineral is based upon the simple fact that wolfram is attacked by aqua-regia, whilst columbite is not. Fifteen to twenty grammes of wolfram, finely pulverized, are attacked by warm aqua-regia, and when the action has proceeded as far as possible the residue is collected, the tungstic acid separated by a solution of ammonia, and the residue again submitted to the action of aqua-regia. These operations are repeated five or six times, as long as any tungstic acid can be obtained from the residue. Finally, the latter becomes quite black, and then consists almost entirely of the mineral columbite (or niobite) mixed with some grains of transparent quartz.

After ascertaining by analysis the nature of this residue I passed it under the microscope, and saw the mineral in its ordinary aspect. It appeared in the form of angular, irregular, black fragments, more or less metallic, almost vitreous, non-magnetic, resembling up to a certain point brilliant fragments of coal; and giving all the blow-pipe reactions of columbite.

It will be remembered that M. Gustav Rose formerly ascertained that columbite and wolfram are isomorphous.

I may profit by this opportunity to state that the metal columbium, now called *niobium*, was discovered by the English chemist Hatchett in 1801, and that the metal discovered in 1802 by Ekeberg, and called *tantalum*, was really a new metal, and not the columbium of Hatchett, as Dr. Wollaston declared. The latter is niobium, a metal which has become remarkable by the persevering researches of Heinrich Rose, who has made known all its characteristic reactions. On comparing the observations of Hatchett with what is now known of tantalum and niobium, principally by the admirable analytic studies of Heinrich Rose, the fact alluded to becomes, I believe, incontestable.

London, Aug. 31, 1867.

ON THE ELECTRICAL RESISTANCES OF THE FIXED AND VOLATILE OILS*.

By T. T. P. BRUCE WARREN.

THE want of an acknowledged and reliable means of recognising the purity or condition of samples of oils has long been felt by pharmacutists. No tests, or system of tests at present used are free from objection. An inspection of the optical characters of the oils, whether fixed or volatile, will be sufficient to confirm the truth of this observation.

The polariscope has at best a very limited scope of application, whilst the determination of the refractive or dispersive qualities requires such precise adjustments that the suitability either of the one or the other for the purposes of a technical test may be fairly questioned. The refractive power of the oils, both fixed and volatile, has so small a variation, even between the two extremes of the scale here given, that the difference produced on the refractive power of any oil by the addition of a small quantity of another, would be barely perceptible. The objection against the measurement of the dispersive action as a means of expressing the value of an oil, is that the determination of the differences of indices of refraction for the extreme rays is at once tedious and unreliable; the scale of dispersions offers, however, a much wider range of differences.

It is probable that the comparison of two samples of oil by the irrationalities of their dispersion is worthy of some attention. I am not aware of its being applied as a test, but the samples could stand side by side with respect to the illuminating source, and their spectra projected side by side could be easily observed and compared.

The tables here given of the dispersive powers, and the irrationalities of dispersions, are by Sir David Brewster; the refractive powers are principally by the same authority.

OPTICAL QUALITIES OF OILS.

Name of Oil.	Index of Refraction.	Dispersive Power.	Difference of Index of Refraction for extreme rays.
Anise	1.601	.077	.044
Almond bitter	1.603	.079	.048
Almond sweet	1.483	—	—
Angelica	1.493	.051	.025
Bergamott	1.471	—	—
Cassia	1.641	.139	.089
Carraway	1.491	.049	.024
Castor	1.490	.036	.018
Camomile	1.457	—	—
Cloves	1.535	.062	.033
Cumin	1.508	.065	.033
Dill	1.477	—	—
Fennel	1.506	.055	.028
Juniper	1.473	.047	.022
Lemon	1.476	—	—
Lavender	1.462	—	—
Nutmeg	1.497	—	—
Olive	1.470	.038	.018
Poppy	1.463	—	—
Pennyroyal	1.482	—	—
Peppermint	—	—	—
Rape-seed	1.475	—	—
Sassafras	1.534	.069	.032
Spearmint	1.481	.054	.026
Alcohol	1.372	.029	.011
Turpentine	1.475	.042	.020

* Read before the British Association in Section B.

Table of Oils.—Arranged in order according as they contract the less refrangible, and expand the more refrangible spaces (irrationalities of dispersion).

Oil of Cassia	Oil of Nutmeg]
" Bitter Almonds	" Peppermint
" Aniseed	" Castor
" Sassafras	" Nut
" Fennel	" Olive
" Cloves	" Sweet almonds
" Turpentine	" Alcohol
" Carraway	

Although bromine and iodine exert on some of the essential oils chemically characteristic effects, it does not appear certain to what extent the action may be modified by the addition of small quantities of other oils; consequently the chemical phenomena, as well as a knowledge of their specific gravities, and boiling points, cannot be considered as offering any assistance to the detection of accidental or intentional impurities when existing in small quantities.

The process which I have to submit to you is one which has given great satisfaction in all the experiments which I have made, and was suggested by a discovery due to M. Rousseau, quoted by De la Rive,* "that olive oil when mixed with $\frac{1}{100}$ th part its volume of oil of poppies, increased the number of vibrations of a magnetic needle in a given time, when the same was included or made to form part of a voltaic circuit." This isolated fact would be of service for the determination of the purity of olive oil, if oil of poppies were the only sophisticating ingredient.

I thought it useful to extend the observation to the effects produced by other oils when mixed with oil of olive, and to ascertain how far the process might be applied as a test for the commercial and chemical valuation of oils generally.

For this purpose I had first to measure the resistances offered by a column of each of the oils experimented on, having in each case the same length and sectional area.

From the low resistances possessed by the volatile oils, the apparatus used by M. Becquerel for ascertaining the resistances of liquids might be employed,† but from the high resistances offered by the fixed oils I have designed a modification.

I must here acknowledge the obligation I am under to W. Hooper, Esq., for the use of Sir William Thomson's delicate astatic reflecting galvanometers, and a battery which possesses remarkable constancy, viz., that of Daniell's as modified by Minotte.

With such a galvanometer as used for these tests, the deflections obtained are strictly proportional to the resistances, and by means of noting the deflection produced through a constant resistance, by a standard current, it is easy to compare the results obtained at different times and under different conditions. The standard current represents a known relation to the full electro-motive power employed.

The resistances of the essential oils were determined with one cell; and I may remark that I was considerably surprised at the low resistances of the volatile oils, this being the reverse of what, judging from the composition of them generally, I was prepared to expect.

The adulterants of the volatile oils are principally turpentine and alcohol.‡

* "Treatise on Electricity" (translated by Walker).

† Since writing this I find the following note in "Paris's Pharmacologia" (1833), under the article "Olive Oil." "M. Rousseau has discovered the curious fact, that of all the oils, both vegetable and animal, olive oil most feebly conducts electricity. It may be stated that at a medium it acts 675 times more feebly than the others. Two drops of oil of beechmast, or of poppy seeds, poured into ten grammes of olive oil, renders the needle four times more sensible. This difference, therefore, furnished M. Rousseau, by means of his diaphragm, a test for determining adulterations with precision."—(*Journal de Pharmacie*, t. ix. p. 587.)

‡ See "De la Rive's Treatise," vol. ii.

§ The foreign oils are no doubt sometimes entirely substituted for the English oils, or largely diluted with them.

Compared with any of the essential oils, turpentine has an immense resistance, whilst that of alcohol is enormously lower than any of them, except perhaps that of oil of bitter almonds, which is so low that I did not measure it.

The importance of this general fact is at once apparent, since the addition either of alcohol or turpentine in the smallest quantity is readily detected; and the quantity denoted by the variation in the deflection, either when compared with a standard of known purity, or by the resistances themselves.

The oils of lemon and bergamott, when mixed with a small proportion of turpentine, do not, however, show such marked differences as the generality of the essential oils. The addition of turpentine reduces the conducting power, or, in other words, increases the resistances to a very perceptible extent in all oils except lemon and bergamott, but in these two last cases it becomes, nevertheless, perceptible in the effects of increased resistance,—in these cases, however, a property not solely confined to turpentine aids in its detection, and consequently enlarges the scope of the application of this test. Large quantities of turpentine are instantly perceptible in increasing the resistances.

The addition of turpentine to oil of lavender is more strongly marked by this test than in any other case.

The following tables contain the averages of six tests on each oil, taken at different times. For reasons noted farther on, the same sample should not be used for a second test. The volatile oils were obtained from reliable sources, and were supplied as perfectly genuine and in mature condition. I am particularly indebted to Messrs. I. and H. Smith for the liberal manner in which they have supplied me with information respecting the samples obtained from them. I met with great difficulty in procuring samples of cotton seed oil, and although my samples are unauthenticated for condition or purity, I must acknowledge my obligation to Mr. Edward Mann, 7, Pall Mall East; for his kindness in procuring them.

TABLE OF RESISTANCES OF VOLATILE OILS.
Genuineness of Samples Authenticated.

Name of Oil.	Observed Deflection.	Ohmad's Resistance.
Peppermint, Ang.	224 × 8'94	800,000 *
" " " " " " " "	274 × 8'94	652,160 †
Peppermint, German . . .	236 × 8'94	759,000
Carraways	202 × 8'94	90,000
" " 2nd sample	202 × 8'94	90,000
Cloves	205 × 8'94	81,000
Bitter Almonds	—	— ‡
Aniseed	57 × 8'94	3',144,000
Bergamott	94 × 8'94	1,906,000 §
Lemon	53 × 8'94	3',376,000
Lavender, Ang.	310	5,244,000 ||
" Mitcham	250 × 8'94	717,000 ¶

* 1858 product. † 1861 product. ‡ Beyond range of observation.
§ Sample turbid. || Deflection rising rapidly to 350. ¶ Deflection increasing slowly. This arises from electrolysis.

ADULTERATED SAMPLES.—VOLATILE OILS.

Name of Oil.	Adulterant.	Observed Deflection.	Ohmad's Resistance.
Peppermint, Ang.	Turpentine..	185 × 8'94	969,000*
" " " "	Spirit of wine	43 × 8'94	422,000
Lemon " " "	Turpentine..	52	3',444,000
Bergamott " "	Spirit of wine	157 × 8'94	11,600
" " " "	Turpentine..	92 × 8'94	1',949,000
Lavender, Ang.	" " "	104	15',630,000

* Product of 1858.

The effects produced by mixing different specimens of the same oil together are also perceptible, thus the German oils of peppermint, or foreign samples of lavender oil produce modifications in the electrolysis.

In testing the fixed oils a much higher battery power is required; this arises simply from the fact that they all possess much lower conducting powers than any of the essential oils.

For these tests thirty-two cells were used.

TABLE OF RESISTANCES OF FIXED OILS.

Samples Purchased as Genuine.

Name of Oil.	Observed Deflection.	Ohmad's Resistance.
Olive	40 × 8'94	554', 637,600
" " " " " " " "	68	* 3,186',000,000
Sweet Almond	40 × 8'94	554', 637,600
" " " " " " " "	35 " 8'94	† 708', 048,000
Castor oil, Italian	91	2,242',152,000
Castor oil, E. I. Elect. . .	206 × 8'94	113', 287,680
Poppy	326 " 8'94	68', 444,640
Turpentine	340	590', 040,000
† Cotton-seeds	220	§ 14', 000,000
" " 2nd sample	130	|| 23', 500,000

* Bleached. † Bleached. ‡ Rising gradually to 300.
§ Sensibility of instrument increased. || Rising rapidly beyond range.

From this table it will be seen that the bleached oils have even a lower conducting power than the unbleached oils; and in this respect olive oil possesses a greater difference than almond oil. It is not easy to explain this.

A singular difference exists between the Italian and the East Indian castor oils. This difference will enable one to detect a very small percentage of the one added to the other.

Cotton-seed oil and oil of poppy, as well as turpentine, are so rapidly altered in their conducting power by electrolysis, that there is not the slightest difficulty in recognising them in samples of oil.

Olive oil, when free from cotton-seed oil or oil of poppy, has its resistance increased by electrification, but if the smallest quantity of either of them exists in a sample of olive oil, it produces a contrary effect by a prolonged contact with the battery.

These results of electrolysis are alone important in determining the condition of a sample of olive oil.

I regret that I have not been able to extend these observations to commercial samples of olive oil of different qualities, and to have included a greater number of fixed oils, from the great difficulty of procuring specimens of reliability in purity or condition.

Liquid Carbonic Acid.—The well-known apparatus employed for so long a time by Mr. Robert Addams for liquefying carbonic acid, has been purchased by Mr. Stewart from funds supplied by the Royal Society, and Mr. Addams has kindly undertaken to make a preliminary experiment with his apparatus, as well as to give specific instructions regarding it. As the exact thermometric value of the freezing-point of mercury has been previously determined by Mr. Stewart, it is expected that the apparatus will furnish the means of verifying thermometers at very low temperatures.

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THE CHEMICAL NEWS.

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ON A METHOD OF RECOVERING SULPHUR AND OXIDE OF MANGANESE, AS PRACTISED AT DIEUZE, NEAR NANCY, IN FRANCE.*

By J. LOTHIAN BELL.

In the manufacture of soda, the use of sulphur plays an important part; the office it performs being to effect, in the form of sulphuric acid, the decomposition of common salt.

The sulphate of soda obtained from this action in its turn is subjected to decomposition by exposure to heat along with carbonate of lime and coal, a process which transfers, practically, almost the whole of the sulphur to the lime, or to the metallic base of this earth, the only exception being the small portion which remains with the soda as an impurity.

This new combination of sulphur is separated from the soda salts by lixiviation, and the portions undissolved, containing the sulphides of lime and calcium, and known as soda-waste, are thrown away.

I will not dwell on the inconvenience the soda-maker is exposed to from having to provide deposit-room for such a large quantity of refuse as the mode of treatment just mentioned gives rise to, nor on the somewhat offensive nature of the soda-waste itself, rendering the alkali manufacturer's heap any thing but a desirable neighbour.

Various are the plans which have been suggested for the recovery of this, the most costly element of the soda-maker's process, but hitherto, so far as actual practice is concerned, the whole of the sulphur employed by them may be said to be still thrown aside after it has once done the duty just alluded to.

Having heard a favourable account of a method in operation, at the Chemical works of the Dieuze Company, near Nancy, by the permission of the proprietors, I visited that establishment in the month of July last, and it is to give a brief account of their process that I now have to ask the attention of this Section.

It will be convenient at this stage of the description to remind you that in most soda-works there exists another residual product, scarcely less embarrassing in its nature than that previously mentioned. The muriatic acid obtained from decomposition of common salt with sulphuric acid, along with peroxide of manganese, is employed very extensively in the manufacture of bleaching powder, a process which gives rise to the generation of a large quantity of liquid chloride of manganese mixed with chloride of iron and free hydrochloric acid. The whole of these solutions are run away into the nearest water-course in the vicinity of the different manufactories.

The process I am about to describe requires the assistance of this second equally valueless material. The operation is as follows:—The soda-waste, after being removed from the vessels in which it has been separated from the soda, is thrown into a tank of stone-work about twenty yards long, by five in width, and six feet deep. In this vessel an intimate mixture is easily effected of the soda-waste and the metallic chlorides of the refuse from the bleaching powder process, and from which latter all the free muriatic acid has been removed in a manner to be hereafter described. Were the free acid still present, a loss of sulphur by the generation of sulphuretted hydrogen would take place, and this on all accounts it is obviously best to avoid.

A few hours suffice to convert the chlorides of manganese and of iron into sulphides, when the soluble chloride of calcium generated by the action is allowed to drain off. The solid matter remaining is cast out into a heap by the side of the tank containing it. In two or three days the heap is turned over, and in a short time a considerable elevation of temperature ensues, indicative of strong chemical action. To restrain this somewhat, the mass is kept moist, otherwise spontaneous combustion would ensue, sulphur would be wasted, and the desired results generally interfered with. During this stage of the process the metallic sulphides, under the joint action of the atmosphere and moisture, are peroxidized, and sulphur is separated. The oxides of manganese and iron so obtained are by subsequent turning over brought into contact with other portions of sulphide of calcium of the soda-waste, and are again converted into their respective sulphides, which give up their sulphur a second time in the way already described. The process is continued so long as there remains any sulphide of calcium from which it is sought to separate sulphur in the manner explained. The sulphur thus liberated is taken up by another portion of the sulphide of calcium of the soda-waste, and a polysulphide of calcium results from the combination, which is soluble in water. The formation of polysulphide continues as long as other portions of the original sulphide of calcium go on yielding up their sulphur to generate the sulphides of manganese and iron.† In this way almost the whole of the sulphide of calcium originally contained in the soda-waste is converted into polysulphide of calcium, hyposulphite and oxysulphide of lime, all of which are easily dissolved in water. Something like four or five days are required to effect these changes. These soluble salts are separated from the insoluble portions of the mass exactly in the same way as the ball alkali is treated for obtaining the soda it contains. Vats resembling in construction those of the soda works, and of a capacity equal to the daily production of soda-waste, are placed near the locality in which the preceding stage of the process has been effected, and in a very speedy manner the polysulphide and other salts are run off as a deep orange yellow solution, hereafter denominated the yellow liquor.

The composition of the insoluble portion is as follows:—

CaOSO ₃	.. .. .	66'248
CaOCO ₂	.. .. .	1'320
CaO	.. .. .	20'982
Fe ₂ O ₃ and Al ₂ O ₃	.. .. .	7'000
MnO	.. .. .	1'500
Insoluble	.. .. .	2'800

99'850

As a refuse this substance will be recognised as being of an inoffensive character to the neighbourhood so far as any subsequent chemical action is concerned. Unlike the original soda waste it contains no ingredient liable to oxidation; it cannot therefore give off any of those unpleasant compounds which more or less are found in the vicinity of all alkali works. It is, moreover, not unreasonable to expect that a matter consisting chiefly of CaOSO₃ and CaO may be found useful as a stimulant to various descriptions of soils, and thus the whole of the S used in the soda process in one shape or another may be rendered useful instead of being a nuisance, as is the case at present.

The residual products from the bleaching powder works are received into a tank so built that free hydrochloric acid does not destroy the structure. By this means any

* Along with this formation of polysulphide of calcium, there goes on at the same time a generation of hyposulphite and oxysulphides of lime due to the liberation of oxygen from the metallic oxides at the moment of being again converted in sulphides.

insoluble portions are separated, and the clear liquid is run off into an adjoining cistern.

To this acid solution of chloride of manganese and iron, is added that of the polysulphide of calcium and lime compounds of sulphur, obtained in the manner previously given. The presence of free hydrochloric acid causes an immediate precipitation of all the sulphur, free from the sulphide of calcium, and the accompanying substances containing sulphur; and the addition of the yellow liquor is continued until the first appearance of a black colour, indicative of all the free acid being neutralized, and the first portion of iron from the chlorine residuum commencing to be precipitated. The precipitated sulphur is removed from the liquid, and the greater portion of the accompanying water is separated by pressure. After this the remainder of the moisture is expelled by a very low heat, and the sulphur is then employed for producing sulphuric acid.

It is obvious from what has preceded that the chlorides of manganese and iron must be left in the solution from which the free hydrochloric acid has just been removed in precipitating the sulphur; and it is in this way that the neutral solutions of these metals are obtained which are required for operating upon subsequent portions of the soda-waste.

This process has been in operation at Dieuze for some months, and at the present moment by its means about one and a half tons of sulphur are being recovered daily. It will be seen that no new material is required, the only ingredients being the two waste products from the manufactory itself. The apparatus employed is of a most simple character, consisting almost entirely of tanks on which the expense for maintenance will be a mere trifle—in fact the whole cost is one of labour, which at the Dieuze works amounts to something like 40s. per ton on the sulphur obtained.

Supposing 40 per cent of the sulphur used in this kingdom to be thus recovered, the annual saving this process is capable of effecting will amount to a considerable sum.

Instead of employing the "yellow liquor" and the chloride of manganese in the way set forth in this paper, an attempt has been made at Dieuze to employ both as a means of recovering manganese, a desideratum with bleaching powder makers as eagerly sought for as the regeneration of sulphur has been with the soda manufacturer. I shall with your permission proceed to describe the process which the owners of the establishment assured me promises to be a success.

The acid solutions from the bleaching powder works, being all required in order to precipitate sulphur by means of the free hydrochloric acid, contain a considerable quantity of neutral chlorides of manganese, and will remain on hand. To such portions of these neutral chlorides as are not used in the sulphur process itself, yellow liquor is added in a suitable tank so long as a black precipitate falls, which is variable in quantity with the varying composition of the manganese used. The black precipitate consists of sulphide of iron and free sulphur, which can be collected and burnt in an ordinary furnace for burning pyrites.

The iron being thus all separated from the metallic solution, a fresh quantity of yellow liquor is added, by which all the manganese is thrown down, the precipitate consisting of some free sulphur and sulphide of manganese.

The sulphide of manganese is burnt in the same way as that of iron, but the residue, instead of being all oxide, as is the case when the sulphide of iron is under treatment, is composed of protoxide and binoxide of the metal mixed with a certain quantity of sulphate of manganese. The oxides are separated in the usual way by water, and being almost chemically pure, are of great value to the glass-makers, to whom the presence of the iron usually found associated with the manganese of commerce, is a subject of great inconvenience.

The sulphate of manganese as a concentrated solution is added to nitrate of soda in quantities denoted by the equivalents. When heated, decomposition takes place; nitrous acid is given off, which may be used in the sulphuric acid chambers, or otherwise disposed of; and the residue consists of sulphate of soda and the protoxide and binoxide of manganese, which latter represent, so far as available oxygen is concerned, a manganese amounting to 65 to 70 per cent of binoxide. The oxides of manganese are separated from the sulphate of soda in the usual way by washing with water, and both used for any purpose to which these two substances are commonly applied.

I may add that these operations have been carefully examined by some of the leading men of science of France, both in their practical and scientific relations, and that in the recent adjudication of prizes at the International Exhibition, at Paris, the inventors had a gold medal awarded for the service they are considered to have rendered to the industry of their country.

THE PHYSIOLOGICAL ACTION OF THE METHYL COMPOUNDS.*

By Dr. B. W. RICHARDSON, F.R.S.

THE author opened by briefly recapitulating the work of the previous reports, and by noting several facts showing in a satisfactory manner the practical good that had followed their publication. Passing to the methyl compounds, the substances now to be considered, he said they were of unusual interest, inasmuch as the poisonous gas known as fire-damp, and the beneficial agent chloroform, were included in the group. He then divided the substances to be described, in regard to their physiological action, into two distinct groups, with their chemical constitutions or characters—giving first in detail a list of the methyl series as follows:—

Methylic alcohol.	Bromide of methyl.
Hydride of methyl; marsh gas; fire-damp.	Acetate of methyl.
Chloride of methyl.	Methylic ether.
Iodide of methyl.	Nitrite of methyl.
	Nitrate of methyl.

The methylene series was given as follows:—

Chloroform (Terchloride).	Tetrachloride of carbon.
Bichloride of methyl.	

Dr. Richardson next discussed the action of the above substances in detail. The following is an abstract of his observations:—With regard to alcoholic fluids, he observed that the physiological law was that the period of time required by these bodies to produce their effects, and the period of time required for recovery, turned altogether on the boiling point of the fluid used. This was so certain that when the boiling point of one fluid and its action were known, the action of other fluids might be predicted from their boiling point. The explanation was simple. The alcohols taken into the body did not enter into any combination which changed their composition, but passed out of the body, chemically, as they entered it, and their evolution, and the time of their evolution, was the mere matter of so much expenditure of force, caloric, to raise them and carry them off. He had tested this, and found that intoxicated animals recovered more or less quickly according to the temperature in which they were placed—those in the higher degree returning the sooner to their normal condition. The practical lessons were, that in alcoholic poisoning of the human subject the most important condition for recovery

* Read in Section D, British Association.

was a high temperature; and that as methylic alcohol was more rapid in its action and much less prolonged in its effects than common alcohol, it could be used with great advantage by the physician in all cases where he felt an instant demand for alcohol. All alcoholic bodies are depressants, and although at first, by their calling injuriously into play the natural force, they seem to excite, and are therefore called stimulants, they themselves supply no force at any time, but take up force, by which means they lead to exhaustion and paralysis of power. In other words, the calorific force which should be expended on the nutrition and sensation of the body is expended on alcohol. Dr. Richardson added to his recommendation of methylic alcohol as a medicine the facts that when quite pure it was very palatable, and that it mixed easily with either hot or cold water.

The Hydride of Methyl.—The Hydride of Methyl occurs naturally in the form of fire-damp in mines, and as marsh gas on land. It is made artificially by heating together in a strong flask acetate of soda, caustic potash, and well dried lime. For physiological experiments the Hydride of Methyl can only be administered by inhalation. It is a pleasant gas to inhale, producing no irritation nor yet giving rise to any of those feelings of excitement which are induced by nitrous oxide gas or the vapour of chloroform. It might therefore be ranked, as Mr. Nunneley had long ago ranked it, as an anæsthetic; but, as its effect was evanescent, and the quantity of gas required to produce an effect was very great, it was practically valueless for this purpose. Dr. Richardson then proceeded:—As this gas is often a cause of death in mines, I thought it was worth inquiry—What percentage of it would prove fatal in the air? I therefore had constructed a glass chamber, through which an atmosphere charged with various quantities of the gas could be passed. To my surprise, I found that even pigeons—animals peculiarly susceptible to the influence of narcotic gases—could live in an air charged with not less than thirty-five per cent of the gas, for the space of half an hour; while I could myself inhale the air coming from their chamber with the utmost ease. When at last by pushing the gas further, death is induced—it comes as a very gentle sleep, so gentle, indeed, that it is difficult to say when the action, either of the circulation or of the respiration, is over. The lungs are left with the blood in them, the heart has blood on both sides, and the blood itself retains its natural character. The death is by the slow negation of breathing. We may gather from these facts many important lessons in regard to the risks and dangers of miners from fire-damp. I should think it is almost impossible that any body of men, or any men who were awake in a mine, could be so entrapped with fire-damp only as to die in the absence of an explosion. In accidents where this seems to have occurred, I should imagine that with the fire-damp there is also evolved carbonic acid gas. I can, however, imagine after an explosion, when the mine becomes for a moment a great vacuum, that there would be sufficient entrance of the gas to produce a fatal atmosphere. In such case death would be prolonged, but as easy as sleep; two truths, which in cases of accident should inspire thankfulness and hope—thankfulness that those who thus die for us suffer little; hope as to the possibility of rescue, which should not for days be abandoned. The best direct means of recovery of those under the influence of fire-damp is exposure to heated air, and the administration of warm nourishing drinks, such as milk. Alcoholics do decided harm. From this point the author proceeded with a description of the action of chloride of methyl, the iodide, bromide, and acetate, methylic ether, nitrite of methyl, and the nitrate, over which we must pass, to record his more general researches on chloroform and its allies.

Methylene Compounds.—Dr. Richardson spoke at length on these compounds as anæsthetics, describing the nature and action of chloroform, tetrachloride of carbon,

and bichloride of methylene (with which he put a pigeon to sleep under a glass shade). He had been led to the conviction that the cause of death from chloroform was in every case due to the arrest of nervous function, and that the idea of any direct action of the agent on the muscular structure of the heart was without foundation. He had conducted eighty-seven experiments specially to determine the direct influence of chloroform on the heart, and found in every case that organ capable of reaction on its exposure to air, while the lungs were always bloodless, white, and collapsed. The best means of restoration in impending death from chloroform was the introduction into the lungs, by artificial respiration, of air heated to 130° Fahrenheit. For doing so a small pair of handbellows connected with a thin tube of platinum in a coil was found to answer well, as with a spirit lamp the coil could be almost instantly made hot. It was only necessary to inject the air through one nostril. The tetrachloride of carbon had recently been brought into use as a substitute for chloroform. With regard to it Dr. Richardson said—As this substance is now gaining importance, I have thought it proper to subject it to very careful experiment, and I feel it my duty to state, both on theoretical and practical grounds, that it is far more dangerous than chloroform, and if it were as generally used it would act fatally in a much larger number of cases. In its action it presents the same four stages as chloroform, but the second stage is more prolonged and intensified. In one animal, a rabbit, tetanic convulsion of an extreme character was presented during this stage. But the worst feature in the administration of this body is the slowness of its elimination—a slowness fully accounted for by the boiling point. Saturating the nervous centres, and expending their force to the fullest, it kills far more quickly and determinately than chloroform, and so completely is motion paralysed that the muscles scarcely respond to galvanism five minutes after dissolution. In order to make an exact comparison—and it is from this comparison I draw the results arrived at—I placed animals of the same kind, at the same time, at the same temperature, in chambers of the same size, and administered the same doses of chloroform and of the tetrachloride of carbon. Pigeons and rabbits alike gave evidence of the more severe effects of the latter substance. In this opinion my friend Dr. Sedgwick, who has rendered me valued aid in these inquiries, entirely coincides.

The Bichloride of Methylene.—The last compound on our list is of great interest, from the circumstance that it promises to be a new and valuable anæsthetic. In experimenting with chloride of methyl in ether, I was so struck with its good action that I asked Mr. Robbins, the chemist who had prepared the compounds for me, to endeavour to find, from the methyl bodies, a more stable compound, having similar physical properties. In a few days he brought me the fluid I now place before the Section, made for him by Dr. Versmann. This fluid is the bichloride of methylene. It is formed by the action of sulphuric acid on zinc in chloroform, and it differs from chloroform in that one atom of chlorine is replaced by an atom of hydrogen. Its boiling point is 88° Fahr., and the odour of its vapour is sweet, and much like that of chloroform. On testing it physiologically, I found it to be a gentle and perfect general anæsthetic. Under its influence animals lapse into the third stage of anæsthesia with the slightest exhibition of the stage of excitements. The insensibility is deep and well sustained, and the recovery quiet and good. (Dr. Richardson here showed the experiment already mentioned of putting a pigeon to sleep.) In some experiments, in order to see the extreme effect, I have carried the administration to the extent of arresting the phenomena of life. I have thus learned that the respiration and circulation under the last action of this agent cease simultaneously, and that the muscles retain their irritability for even an hour after death. The lungs are left with blood in the respiratory circuit, both sides of the

heart are changed with blood, and the blood itself remains unaltered in physical property. Compared with other anæsthetics, the bichloride of methylene appears to me to combine the anæsthetic power of chloroform with the safer properties of ether. It is too early to speak positively on this point, but if the expectation be fulfilled, the perfection of a general anæsthetic will have been obtained for the benefit of the world. And, even should this happy result not be accomplished, the way at least is paved towards the discovery of some intermediate body which shall answer to the required physical demand. In reviewing the facts connected with the physiological action of the methyl series, we gather that, according to their composition, they exert certain definite influences on different parts of the nervous organism. The oxide produces an influence specifically its own, that of slowly paralysing the motor function without destroying common sensibility. The nitrite and nitrate rapidly paralyse the centres of motion, while the chloride, and the iodide, together with the substitution chlorine compounds, not only paralyse motion but also destroy sensation. I conclude this report with one other observation. At first sight it may seem that the isolation of the phenomena produced by special agencies, and the discovery of a new anæsthetic, are sufficient characteristics of this research. With every respect, I submit that a broader question is involved. At the meeting at Birmingham I suggested, almost with a feeling of fear, that out of these studies might spring up a fixed principle of therapeutic discovery. Now, I have the conscious happiness of knowing that the hypothesis was correct. I feel convinced by this longer experience that by continued labour we shall be able to pronounce the precise physiological meaning and value of all the organic compounds, to extend the knowledge of curative action of these compounds to every condition of disease that is physically remediable, and to bring positive Science of Therapeutics to a position that shall stand out as a leading fact in the scientific advancement which the British Association so fervently encourages, and which at once solidifies and beautifies the progress of the present age.

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEETING AT DUNDEE.

President, PROFESSOR BENTLEY, F.L.S. M.R.C.S. &c.

THE President opened the proceedings on Tuesday Sept. 3 by delivering a most interesting address on "the study of botany in connection with pharmacy." Last year he gave an address on the same subject, when he confined himself to the consideration of some of the more immediate and direct advantages which the pharmacist, would derive from a knowledge of botany, while this year he spoke of its value, as a mental training, and as a recreation. Having alluded to the great advantages to be derived from the study of such branches of natural history as botany, in training the mind to observe correctly, discriminate accurately, and to acquire orderly and systematic habits, the president expressed an hope that it would not be long before such studies will become an essential part of the education of our youth. He then spoke of the advantage which the pharmacist would derive from taking up the study of a natural science by the combination of scientific with the more purely practical studies of their profession, thanking the liberal and enlightened founders and subsequent supporters of the Pharmaceutical Society for doing much to drive away the erroneous idea that a pharmacist should confine

his attention entirely to the practical parts of his business. The president then proved the study of botany to be eminently calculated to prove an agreeable and healthful recreation to the pharmacist, urging upon the young student of pharmacy, the importance of its study during his pupilage in order that he may acquire that knowledge of its details and technicalities, as will enable him hereafter to pursue and enjoy it as a recreation, and concluded by thanking the local committee for the kind hospitable manner in which they received the visitors and for the very satisfactory arrangements they had made for holding the meetings of the conference.

We subjoin abstracts of the papers read during the sittings.

"On the Adulteration of White Precipitate."

By J. B. BARNES, F.C.S.

Seventeen years ago I tested some white precipitate, in the stock of a highly respectable pharmacist, and found it contained 50 per cent of chalk, it had been supplied by a large wholesale house, at the price of a pure article.

I have received from members of the Conference, residing in the principal towns 58 samples, and three other specimens—small portions of each of these parcels were separately exposed to the action of a strong heat. Of this large number (61) four only exhibited evidence of the adulterant; from Bristol, I received four specimens, No. 1, was pure No. 2, contained 74.7 per cent of carbonate of lead, No. 3, contained 22 per cent of chalk, and No. 4, consisted entirely of carbonate of lead. From North Shields, three samples, one of them said to have been obtained by the retailer from Newcastle, and contained 94 per cent of chalk. One sample from Shrewsbury contained a trace of peroxide of iron, the remaining samples were all pure—I venture to think the result is very creditable to the members of our profession, the samples having been obtained in neighbourhoods where it might have been supposed that adulterated samples would be met with; indeed, my Bristol contributor states that he obtained his specimens from a locality where he was sure to be able to find adulterated drugs.

"Notes on Effervescent Citrate of Magnesia."

By E. DYMOND, BIRMINGHAM.

The author protests against the pleasing deception which is practised in the sale of the various popular granulated effervescent compounds, being almost without exception known by names which do not express their composition and real character, and he holds that the welfare of true pharmacy is in jeopardy whilst we tacitly recognize such departure from correct chemical nomenclature, and from those obligations which we are under to the pure truths of science and morality. The writer placed upon the table a specimen of saccharated effervescent citrate of magnesia which fulfils the conditions required in this preparation of brisk effervescence during the discharge of carbonic acid, and a nearly bright subsequent solution.

"Remarks on a Specimen of Seaweed Char."

By Ed. C. C. STANFORD, F.C.S.

Mr. Stanford introduced to the meeting an interesting specimen of charcoal, obtained by the carbonization of tangle. This substance consists of the long stems of *Laminaria digitata*, which are thrown up in great abundance on the western shores of the outer Hebrides; these are collected in the winter and dried in the air; these, when first thrown up, are long fleshy stems, 7 to 8 feet in length, and about the thickness of the wrist, but when dried, present hard, horny, flexible rods, about the size

of the finger. These, when carbonized, swell out into a highly porous charcoal, about three times their original volume.

The char contains about 40 per cent of salts free from sulphides and very rich in iodine.

After lixiviation the residual char has the following composition; it varies slightly, and the average proximate analysis in the dry state, is here given:—

Carbon	50
Phosph. lime	4
Carbonate of lime	20
Carbonate of magnesia	6
Silicic acid	5
Alumina	2
Sulphate of potash	5
Chlor. iodine.	5

and about 1.25 per cent ammonia.

It generally contains about 15 per cent of water, which is very difficult to separate, the charcoal having a most powerful affinity for moisture.

Attention was called to the remarkable analogy between the chemical composition of this char and that of animal charcoal, which appeared to class it with that substance, and render it unlike any other char of a vegetable origin. This char cannot be used for sugar refining, on account of the large percentage of carbonate of lime; but it possesses decolorizing and deodorizing properties, superior, weight for weight, to the best animal char; tested with solution of caramel it decolorizes 25 per cent more than animal char under the same conditions.

It has been subjected to continued filtration of the thickest town sewage, for several months, without the least clogging, and its efficacy after this treatment remained unimpaired.

This communication was merely preliminary, the author promising the results of further investigation on this and other specimens of seaweed char.

The tangle char was bought before the meeting as a cheap and efficient substitute for animal char in its application other than that of sugar refining; and its introduction excited an interesting discussion.

"On Glycelæum, a Proposed basis for Ointments."

By T. B. GROVES, F.C.S.

Take of

Almond meal	½ oz.
Glycerine	1 "
Olive oil	3 "

Mix s. a. It may be effected in a mortar in the ordinary way, up to nearly the end of the operation; but it is better, I think, to use the spatula and "slice" in the last addition of oil. It will then form a soft, semi-gelatinous paste, which, when mixed gradually with water or a watery fluid, forms readily an emulsion. The glycerine it contains being protected by the oil it does not quickly deliquesce, though when exposed to the air for some time it does often somewhat. It is of course unaffected by the ordinary temperatures of the body; if it were otherwise, its softness would be an objection to its use; as it is, it leaves plenty of room for powdery admixtures of every kind.

It is only essential to remember that the body in the first place must not precipitate emulsine, in the second place must be a fluid. I have in several ways attempted to emulse lard. I have melted it and succeeded perfectly, so long as it remained fluid; but if stirred after solidification, the emulsion was at once "inverted," or as Mr. Proctor styles it, converted into a "negative" emulsion, i.e. the glycerine is emulsed in the fat, and not the fat in the glycerine.

The advantages I attribute to glycelæum as compared with ointments and with plasma, I imagine to be these:—Ointments are greasy, prone to rancidity, do not "touch" in a strict sense, watery surfaces, and are not easily removed from the surfaces to which they become at-

tached; on the other hand they are cheap, they are fatty, and they are repellent of moisture.

Glycelæum has been little tried as a remedy; I have had difficulty in finding persons to make a trial of it. Dr. Tilbury Fox has, however, at Mr. D. Hanbury's suggestion, made some experiments with it, and reports "that he likes it very much; that it is a capital thing where it is a desideratum to get hardened parts into a more 'supple' condition." Although I can bring but one testimony in its favour, it must be allowed to be a first-rate one.

Still less trial has been made of glycelæum as a vehicle for the administration of oils and balsams, though it would not be difficult to find stomachs that support with difficulty castor and cod-liver oils, and balsam of copaibæ. As "oiled" melted butter is known to upset a weak stomach, whilst well-made, i.e. well-emulsed melted butter does not, it might be inferred that an emulsed oil would in some cases agree with the stomach when the plain oil would not. I am convinced of this, that the glycelæum copaibæ, stiffened with powdered cubeb, would form a more elegant and a more supportable elctuary than the nasty and imperfectly mixed mass one commonly meets with.

I have already alluded to the fact, that it is to the emulsine contained in the oil-seed we must attribute the extraordinary emulsive power of these vegetable powders. (Certainly no organic principle has been more consistently named than it.) This I have proved experimentally, by preparing some of the substance, and trying it in its pure state. I found that five grains dissolved in one drachm of water would emulse into a jelly four drachms of olive oil (using the spatula, not the pestle). I prepared the emulsine by digesting for a few hours powdered almond meal with tepid water filtered, and added to three measures of the filtrate five measures of rectified spirit, collected the precipitate and dried it at a temperature not exceeding 100°.

ON A REAL IMAGE STEREOSCOPE.*

By J. CLARK MAXWELL, F.R.S.

In all stereoscopes there is an optical arrangement by which the right eye sees an image of one picture, and the left eye that of another. These images ought to be apparently in the same place and at the distance of most distinct vision. In ordinary stereoscopes these images are virtual, and the observer has to place his eyes near two apertures, and he sees the united images, as it were, behind the optical apparatus.

In the stereoscope which I have had made by Messrs. Elliott Brothers the observer stands at a short distance from the apparatus, and looks with both eyes at a large lens, and the image appears a real object close to the lens.

The stereoscope consists of a board about two feet long, on which is placed—1. A vertical frame to hold the pair of pictures, which may be an ordinary stereoscopic slide turned upside down. 2. A sliding piece near the middle of the board, containing two lenses of six feet in length, placed side by side, with their centres about one inch and a quarter apart. 3. A frame containing a large lens of about eight inches focal length and three inches diameter.

The observer stands with his eyes about 2 feet from the large lens. With his right eye he sees the real image of the left-hand picture formed by the left-hand lens in the air close to the large lens; and with the left eye he sees the real image of the other picture formed by the other lens in the same place. The united images look like a real object in the air close to the larger lens. This image may be magnified or diminished at pleasure, by sliding the piece containing the two lenses nearer to or farther from the picture.

* Read before the British Association, in Section A.

ON THE ANALYSIS OF CAST-IRON.

By EDMUND G. TOSH, Ph.D.

(Continued from page 95.)

Estimation of Graphite. 2 to 3 grammes of iron were treated with dilute hydrochloric acid, and when solution approached completion a considerable quantity of strong acid was added to separate the last portions of iron and manganese. The insoluble matter, consisting mostly of graphite, was collected on a carefully weighed filter, washed with hot water, dilute hydrochloric acid, solution of caustic soda, and hot water again, successively, lastly with alcohol and ether to remove oily hydrocarbons as recommended by Max Buchner.* By washing with dilute acid and with alkali, iron and silica or oxide of silicium were separated. After drying at 120° C. the filter and graphite are weighed, and burned away. The small residue (a mere trace of silica or titanitic acid) is weighed, and this weight subtracted from the first gives the amount of graphite. The results obtained agree very closely, as shown in the two following cases:—

1. 2.36725 grms. iron gave 0.08375 grm. insoluble matter, containing 0.01725 grm. incombustible residue. Graphite per cent = 2.978.

2. 2.991 grms. iron gave 0.1095 grm. insoluble matter containing 0.01725 grm. incombustible residue. Graphite per cent = 3.0842.

In washing the graphite with solution of soda, there was always a brisk effervescence, due according to Schaffhütl † to the oxidation of oxide of silicium to silicic acid, by decomposition of water, with consequent liberation of hydrogen.

The difference between the quantities of graphite and of total carbon, is the amount of carbon in the combined state.

Estimation of Silicium. About 2 grammes of the iron were dissolved in aqua regia, and evaporated to dryness. The insoluble matter was collected, washed, dried, ignited and cautiously deflagrated with nitrate of potash. Graphite is thus quickly burned away: the fused mass is extracted from the crucible by means of water. The alkaline silicates in solution are decomposed by hydrochloric acid in considerable excess, and the whole evaporated to dryness. To the dried mass a few drops of hydrochloric acid are added, and afterwards water. The insoluble silica is filtered off, washed, dried and ignited till quite white. From its weight the proportion of silicium in the iron may be deduced.

Estimation of Sulphur. About 3 grammes of the iron were dissolved in nitric acid, with the occasional addition of a few drops of hydrochloric acid, and evaporated to dryness. The residue is dissolved in the least possible quantity of hydrochloric acid, and water added. The sulphuric acid in the clear, filtered solution is precipitated by chloride of barium. After standing 24 hours, the sulphate of baryta is collected. It is generally contaminated with a little iron which may be removed by treatment with dilute hydrochloric acid.

Estimation of Phosphorus. 3 grammes of the iron are dissolved in aqua regia, the solution evaporated to dryness, and the insoluble matter filtered off. The perchloride of iron solution is reduced to the state of protochloride, by heating with sulphite of soda. Although perfectly reduced, the solution still retains a yellow colour due to dissolved organic matter. All excess of sulphurous acid is boiled off, a little perchloride of iron is added, and the solution cautiously neutralised by means of carbonate of soda or ammonia, till the precipitate formed does not dissolve again. This small portion of peroxide of iron containing all the phosphoric acid, is filtered off, washed, redissolved in a little hydrochloric

acid, and the phosphoric acid precipitated as ammonio-phosphate of magnesia, the iron being held up in the ammoniacal solution by citric acid.

Estimation of Manganese. 3 to 4 grammes of iron are dissolved in aqua regia; the solution is largely diluted and filtered, and neutralised with carbonate of soda or ammonia till of a deep brown colour. The iron is precipitated by acetate of soda, and the solution immediately boiled. The large precipitate settles quickly, the clear liquid is poured off and filtered. After three washings by subsidence and decantation, the precipitate is thrown on a large filter and again washed. The bulky solution containing all the manganese is evaporated to small volume and refiltered. The manganese is first precipitated by sulphide of ammonium, the sulphide collected and washed with sulphide of ammonium water, redissolved in hydrochloric acid, the solution boiled, and the manganese reprecipitated as carbonate by carbonate of soda, filtered off, washed, dried and ignited till of constant weight, showing its perfect conversion into Mn_3O_4 .

Titanium. The estimation of this element in any substance is somewhat uncertain, and its determination in pig iron can scarcely be accurately accomplished. Its detection in iron is not difficult. A considerable quantity (5 grms.) of the specimen is treated with dilute hydrochloric acid, and insoluble collected, graphite burned off, and the residue freed from silica without loss of titanitic acid, by heating with a mixture of hydrofluoric and sulphuric acids as recommended by Riley.* After driving off sulphuric acid, titanitic acid is left behind, which may be distinguished by the violet reaction it gives with microcosmic salt and a little tin in the reducing flame of the blowpipe.

It may be approximately estimated in the following way. About 6 grammes of iron are dissolved in hydrochloric acid, and the whole evaporated to dryness. The dried mass is moistened with hydrochloric acid, water added and the solution filtered. Part of the titanium exists in the solution (a) and part in the insoluble (b). The solution, if containing much perchloride of iron, is reduced by sulphite of soda, the excess of sulphurous acid boiled off, a little perchloride of iron added, and the titanitic acid precipitated in combination with the sesquioxide of iron thus introduced, by means of carbonate of soda, as in the estimation of phosphorus. The small precipitate is quickly filtered off, washed, dried, ignited and carefully set aside.

From the insoluble matter (b) graphite is burned off, and the silica is removed by hydrofluoric acid in the presence of sulphuric acid. To the residue after this treatment the small ferruginous precipitate from (a) is added, and the whole fused with bisulphate of potash. When cool the fused mass is extracted with cold water, and from the clear filtered solution, titanitic acid and iron are precipitated by ammonia; the precipitate is slightly washed, and sulphide of ammonium added. The sulphide of iron thus formed is dissolved by sulphurous acid, while the titanitic acid mixed with sulphur is undissolved, and may be collected, ignited and weighed, after which it should be tested as to its purity.

Nitrogen was estimated by the following process of Boussingault. † 5 grammes of the iron under examination are slowly dissolved in very dilute hydrochloric acid. By this means a part of the nitrogen is converted into ammonia, and exists in the solution as chloride of ammonium, and another portion remains in the insoluble, probably combined with the titanium. This insoluble is collected, and the filtered solution is treated in a capacious flask with a considerable excess of caustic lime and boiled. A tube connected with the flask by a tight cork, dips into dilute hydrochloric acid, by which the liberated ammonia is absorbed. Nitrogen is estimated in the graphitic matter insoluble in acid by burning with soda-

* Journ. f. prakt. Chem. Bd. 72. p. 364.

† Journ. f. prakt. Chem. lxxvii. p. 257.

* Journ. Chem. Soc. Vol. p. 311.

† Comptes Rendus. T. lii. p. 1088.

lime, the ammonia formed being also absorbed by dilute hydrochloric acid. Both solutions are now brought together, evaporated to small bulk, chloride of platinum added, the small precipitate collected, washed with alcohol, dried, ignited, and the remaining platinum weighed, from which the amount of nitrogen may be calculated.

Nickel, cobalt, and copper were carefully sought for by operating on large quantities of the various specimens of iron, but evidence of their presence could not be obtained. 63 grammes of iron were deflagrated with a mixture of carbonate of soda and nitrate of potash, the contents of the crucible dissolved out with hot water, and the highly alkaline solution filtered off from the large quantity of sesquioxide of iron. This solution was first neutralised with hydrochloric acid, chloride of ammonium, ammonia, and sulphate of magnesia added, and any phosphoric and arsenic acids allowed to precipitate during 24 hours. The precipitate was collected, washed with ammonia water, dissolved in acid, the solution heated and sulphuretted hydrogen passed through it. A very small light yellow precipitate formed, which proved to be sulphide of arsenic.

In all determinations of iron, where practicable, I have used the volumetric method by means of bichromate of potash, first proposed by my former professor Dr. Penny, of Glasgow, which is I think preferable to that of Marguerite, where permanganate of potash is employed. Bichromate is much more stable than permanganate, and the strength of the solution only requires to be determined once. Besides, in the estimation of iron by Penny's method, there is no fear of the evolution of chlorine, which has to be so carefully guarded against in Marguerite's process.

THE ELECTRIC INDUCTION OF MR. HOOPER'S INSULATED WIRES, COMPARED WITH GUTTA-PERCHA INSULATED WIRES, FOR TELEGRAPH CABLES.*

By WILLIAM HOOPER.

The author referred to the relation existing between the different properties of insulated wires arising from induction. He showed by an extensive series of experiments that an intimate connection exists between the effects of electrification and electrostatic induction, and that the penetration of electricity into the substance of an insulator, when measured by the residual discharge, is a function of the electro-static capacity, and not simply of resistance. He has also shewn that the effects of electrification are increased nearly in the same proportion as the interior inductive action is reduced.

The results render it extremely probable that in rapid signalling through long circuits, as by "waves," the rate of transmission attainable is not increased or diminished in the simple proportion of the electro-static capacities, but in a ratio compounded of it and the interior resistance to inductive action.

This is a matter of serious consideration, for the interior induction, unlike the surface induction, is not reduced by an increased thickness of insulator, which points strongly to the practical advantage derivable from Mr. Hooper's dielectric over gutta-percha in every respect for induction. These results are verified by Mr. Latimer Clark, Mr. Varley, Professor Sir W. Thomson, and Mr. Fleeming Jenkin.

So much superior is Hooper's dielectric to gutta-percha for insulation, that, taking the core of the electric telegraph cable connecting Ceylon with India as an illustration,

at 75° Fahrenheit, the temperature at which cores are tested, it would require a core nearly 2 feet diameter of gutta-percha to equal '38 inch diameter of Mr. Hooper's insulator (that is, 200 lbs. of Hooper's insulator is equal to 576,000 lbs. of gutta-percha), the same conductor being used in each, to obtain the same degrees of insulation.

ANTISEPTIC PROPERTIES OF THE SULPHITES.*

Dr. RICHARDSON read a paper by Dr. Polli, in Section D, "On the Antiseptic Properties of the Sulphites." He stated that he was afraid he might not make a good representative of his learned friend, Dr. Polli of Milan. However, as he had long communicated with Dr. Polli on the subject, and knew well what that gentleman meant, he (Dr. Richardson) had chosen, instead of trying to present the paper as a whole, rather to give the facts presented by him as the results of extended observations. Sulphurous acid was said to be the most active agent in preventing or arresting all organic fermentation. As the acid, however, was not sufficiently applicable in experiment, Dr. Polli had undertaken an investigation as to the action of the sulphites of lime, hyposulphite of magnesia, sulphite of magnesia, sulphite of soda, and granulated sulphite. These substances were found to possess all the properties of sulphurous acid, with the advantage that their action was more uniform and certain and constant. In experimenting on animals and himself, he found that large doses could be taken without risk. On killing animals treated with sulphites, and others not so treated, he found that the former were most slow to decompose, and, indeed, remained quite fresh when the others were putrescent and offensive. Another series of experiments showed that in one class the administration of the sulphites was sufficient to effect a more or less rapid cure in cases where blood-poisoning was present, as in fevers. Dr. Richardson distinctly mentioned, however, that Dr. Polli was anxious to have it clearly stated that he did not attribute this to any curative power in the sulphites, but to the fact that they arrested decomposition, and by so doing allowed the animal to recover by the recuperative power existing in its own constitution. The author thought his observations conclusive as to the excellent influence of the sulphites on the septic diseases, and remarked that it was for the purpose of thus benefiting others that he had brought his researches under the attention of the scientific world. Dr. Richardson laid some of the sulphites before the Department, and mentioned that he would be glad to let physiologists have four or five ounces of any of them for the purpose of experimenting, and that physicians might also receive a small quantity for hospital practice.

Iodine soluble in certain Organic Compounds.—Hlasiwetz. Iodine dissolves to a considerable extent in aqueous solutions of resorcin, orcin, or phloroglucin, without imparting to them any colour. These solutions may be boiled without iodine being volatilised; they have almost neutral reaction, and starch, or carbonic bisulphide does not indicate free iodine. A solution of the latter in alcohol or carbonic bisulphide is decolorised by adding one of the organic bodies mentioned, which may therefore be used in place of sulphurous acid in volumetric determinations by means of iodine. Other organic substances have been observed to behave in a similar, but less decided manner.—(*Akad. Wien*, 131, 1867.)

* Read before the British Association, in Section A.

* Read before the British Association.

ON A NEW FORM OF DYNAMO-MAGNETIC

MACHINE.*

By W. LADD.

It is now thirty-six years since Faraday first published his celebrated "Researches in Electricity and Magnetism;" the foundation then laid has been receiving additional strength as the superstructure has progressed. Faraday has gone to his rest, but the name he always tried to hide behind his philosophy will shine brighter and brighter, until the top stone is raised in future ages. The machine I am about to describe is a part of that superstructure. The repeated application to me for a machine that would give a sufficient light for the purposes of lecture demonstration and would dispense with the galvanic battery, has induced me to give considerable attention to the subject, and I must leave you to judge how far this machine meets, not only that requirement, but also that of lighthouse illumination.

Perhaps the most powerful magneto-electric machine was that constructed by Mr. Wilde, the electro-magnet receiving its charge from sixteen permanent steel magnets, but Siemens and Wheatstone have shown that the residual magnetism left in soft iron, after being under the influence of a battery, or permanent steel magnets, can be augmented from the currents generated by itself, by merely applying dynamic force to the revolving armature, containing a coil of copper wire, the terminals of which are connected with the wire surrounding the electro-magnet; and although great effects were produced in the electro-magnet, the current itself could only be made available by its partial or total disruption—in the former case diminishing the power of the electro-magnet, and in the latter reducing it to its normal condition. But in the machine I have constructed, the power of the electro-magnet is kept up, whilst a separate current, to be applied to any useful purpose, can be drawn off by means of an independent arrangement.

It consists chiefly of two plates of iron; to both ends of each plate is fixed a portion of a hollow cylinder; these plates are then placed a certain distance apart, and insulated from each other in such a manner that the cylindrical pieces will form two hollow circular passages; into these spaces two armatures (known as Siemens's armatures) are placed. The plates are surrounded by a quantity of stout copper wire, connected together, the two terminals of which are brought into connection with the commutator of the smaller armature, so that each change of polarity in the armature will augment the magnetism. When the machine is first made it is only requisite to pass a current from a small cell of Smee's or any other element, for an instant, to give the iron a polarity; it will then retain a sufficient amount of magnetism for all future work.

If the armature in connection with the electro-magnet is made to rotate, there will be a very feeble current generated in it; this passing round the electro-magnet, will increase its power with every additional impulse. It will thus be seen that the only limit to the power of the machine is the rapidity with which the armature is made to rotate, which is entirely dependent on the amount of dynamic force employed. But the great improvement in this machine is the introduction of the second armature, which, although it takes off very powerful currents, generated in its wire by the increased magnetism, does not at all interfere with the primary current of the electro-magnet.

The machine now at the Paris Exhibition measures about 24 in. in length, 12 in. in width, and stands 7 in. high; but this being imperfectly constructed as to its proportions, the results obtained are, no doubt, much less than they would be with a properly constructed machine. Still, I found it would keep 50 in. of platinum wire, 10

in. diameter, incandescent, and when a small voltmeter was placed in circuit with the second armature it would give off 250 cubic centimetres of gas per minute, and in connection with an electric regulator would give a light equal to about thirty-five Grove's or Bunsen's elements, the driving power expended being less than one horse.

I have now to describe a machine on the same principle as that just noticed, but which, instead of having two independent armatures running in separate grooves, has two armatures fixed end to end, so as to appear like one continuous armature, but so placed with reference to each other that their magnetic axes shall be at right angles. By this arrangement there is only one opening required for the armature, enabling us to take full advantage of the horse-shoe form of electro-magnet. The shoes of the electro-magnet and armatures are so proportioned to each other that there is an actual break in the magnetic circuit with reference to each armature alterately, but by their disposition at right angles there never is an actual break in the complete magnetic circuit, but simply a shifting of the principal portion of the magnetic force from one armature to the other at the precise moment required to produce the best effect. The mechanical advantages obtained by this disposition of parts must be at once obvious, as one pair of bearings and set of driving gear is dispensed with, and from the fixing of the two armatures together the currents are made to flow perfectly isochronously. It may be found of advantage to vary the angle of position of the armatures with reference to each other, according to the speed at which they are driven, so that the current given off by the exciting armature may at the precise moment exert its full effect upon the electro-magnet, and thus produce the best effect in the second armature.

ON THE COMMERCIAL ANALYSIS OF SOME OF THE PRODUCTS AND MATERIALS OF THE ALKALI MANUFACTURE, &c.

By C. R. A. WRIGHT, B.Sc., F.C.S.

[Continued from page 152.]

III. Soda Ash.—The commercial valuation of soda-ash is usually restricted to the determination of the percentage of "available alkali" contained therein, by this term being meant the total Na_2O contained in a state capable of saturating a strong acid, as sulphuric; and hence including hydrate, carbonate, aluminate, silicate, sulphide, sulphite, and hyposulphite. The analysis is usually performed by adding the standard acid to the hot aqueous solution of a known weight of ash until a slight acid reaction is obtained; by this means all calcium contained, and the Al_2O_3 contained as aluminate, are estimated as though they were soda. Practically this error is of slight importance; it may be readily avoided by addition of a very slight excess of acid along with some litmus tincture then adding a slight excess of standard sodium carbonate solution, boiling and filtering from the precipitated lake and CaCO_3 : the excess of soda added is now again determined by the standard acid, and thus the exact amount of acid used to saturate the Na_2O present in the "available" state is known. An abuse, however, that has long been practised in the soda trade in connection with this is the following:—The equivalent of sodium is considered to be 24 (instead of 23.04—Stas). Hence by varying the mode of calculation, a varying error is introduced, the available alkali being always represented as more than it really is. If sodium be thus

calculated, the error is $+\frac{0.96}{24}$ or 4.0 parts in 100: if

* Read before the British Association, in Section A.

Na_2O be calculated, the error is $\frac{64-62.08}{64}$ or 3.0 parts in 100; while if Na_2CO_3 be calculated, it is $\frac{108-106.08}{108}$

or 1.8 parts in 100. Hence according to the plan employed in determining the standard of the acid used, according as soda salts are thus used, or other substances, an error of from 0.9 to 2.0 per cent is introduced in the valuation of a 50 per cent ash. Hence arises the custom in many alkali works of invoicing the sales of ash at from 1 to 2 per cents higher than their real strength, it being known that the purchaser will accept the analytical certificate calculated on this erroneous basis. This practice, which is neither more nor less than a barefaced fraud, is by no means universal, nor is it known to many of the purchasers of soda ash; in certain districts, however, it prevails, and is a constant source of vexatious complaint whenever the purchaser happens to employ on his own side a more conscientious analyst. The writer has known soda ash of identical quality invoiced part to one customer as containing 48 per cent, part to another as 49 per cent, and part to a third as 50 per cent, the actual percentage being 48½; the separate consignments being reported also in these different strengths by the analysts in the different towns to which the goods were sent: inasmuch as soda ash is usually valued as so much per cent per cwt,—this amounts to a direct fraud on the purchaser. It sometimes happens that an analyst, known to object to this system, finds that his connection for the analysis of soda ash becomes *nil*, being transferred to some less scrupulous rival.

When the exact composition of a sample of soda ash is required, the following method may be adopted.

(a). A known weight is heated to 150°—200°C., and the loss of weight considered to be moisture.

(b). The residue of (a) treated with hydrochloric acid leaves sand and insoluble matters, and in the filtrate the SO_4 may be estimated volumetrically, or better gravimetrically, by barium chloride.

(c). The CO_3 present is estimated in Mohr's apparatus, or in Fresenius' and Wills', with the addition of some potassium chromate.

(d). A known weight is treated with water, and the solution evaporated to dryness with hydrochloric acid; thus the SiO_2 is determined; the filtrate from this with ammonia throw down alumina, from which the Al_2O_3 (as aluminate) is known.

(e). The insoluble residue of (d) with hydrochloric acid and ammonia, gives the Fe_2O_3 and Al_2O_3 (not as aluminate), the filtrate from this with ammonium oxalate gives the calcium (usually only traces).

(f). A known weight is dissolved in nitric acid, and the Cl estimated by a standard silver solution.

(g). A known weight dissolved in water is oxidized by chlorine, and the sulphate thus formed determined; a known weight is dissolved in water, and the solution divided into two equal parts; in one the iodine required to yield a blue colour when starch and acetic acid are added, is determined, to the other zinc sulphate is added, and in the filtrate the iodine required after removal of sulphide is again determined; from these data the sulphide, sulphite, and hyposulphite are calculable.

(h). The total "available alkali" is determined, the error due to the alumina of the aluminate being eliminated as previously mentioned; subtracting from this calculated as sodium, the sodium corresponding to the SiO_3 , Al_2O_3 , sulphide, sulphite, hyposulphite, and CO_3 found, the difference is calculated as hydrate; this may be checked by adding barium chloride to a known weight, and determining the amount of acid required to neutralize the filtrate: rather more hydrate is usually indicated by this mode than that really present owing to the presence of a portion of aluminate, hyposulphite, &c., incompletely thrown down by the barium salt.

Carefully executed analyses according to this method

have yielded the writer results adding up to 99.8—100.1.

When ferrocyanide is present, it may be estimated by dissolving a known weight of ash in hydrochloric acid, and adding ferric chloride; after standing some time, the precipitated Prussian blue may be well washed, treated with pure potash, and the ferrocyanide determined in the solution by permanganate.

(IV.) Bleaching Powder.—The commercial estimation of bleaching powder only extends to the estimation of the hypochlorite contained therein; the result being, however, calculated as so much per cent of "available chlorine." Of the numerous methods proposed for the determination of the hypochlorite, the one usually employed in the trade is that depending on the amount of ferrous salt oxidized by a given weight of bleaching powder. It frequently happens, however, that instead of a perfectly pure ferrous salt (such as the ammonio-sulphate $\text{FeSO}_4 + (\text{NH}_4)_2\text{SO}_4 + 6\text{H}_2\text{O}$ precipitated by alcohol), the ordinary "protosulphate of iron" of the druggists is used, discoloured crystals being of course rejected; rarely does this substance contain 100 per cent of the compound $\text{FeSO}_4 + 7\text{H}_2\text{O}$, and hence errors frequently are introduced, less chlorine being required to peroxidise a given weight of impure than of pure substance. Again, some analysts neglect to add an acid to the ferrous solution used, and hence the precipitated ferric hydrate is liable to carry down perceptible quantities of ferrous hydrate, again making the apparent amount of chlorine required less than that really requisite. When acid is added, an error is liable to be introduced by the peroxidation of part of the iron by chlorine compounds derived from chlorate that may be present; direct experiments have shown the writer that acid ferrous solutions are perceptibly oxidized by the presence of chlorate in small quantities in the course of a very few minutes, even at the ordinary temperature, although the peroxidation due to the whole of the chlorate is not manifest until after standing some time at 20°C., or, till after heating to ebullition. Lastly, the equivalent of chlorine is frequently taken to be 36 instead of 35.46 (Stas). All these sources of error tend to make the percentage of chlorine found higher than that really present; accordingly it frequently happens that analyses of the same sample by different analysts differ by 1, 2, or 3 per cents of available chlorine; this error becomes of serious importance, it frequently happening that the analysts employed by the seller and purchaser differ in their reports, thus causing much annoyance, and possibly the rejection of the goods as not being of contract strength.

As regards the error introduced by the presence of chlorate in the sample analysed, many careful experiments on the subject have yielded the following results to the writer:—

1. Acid ferrous solutions are peroxidised by addition of a chlorate, at a rate depending on the strength of the solutions, the amount of free acid, and the temperature, the reaction taking place completely after heating to ebullition for a minute, and almost as completely after standing for upwards of half an hour at 20°C., time being, however, required for any temperature short of ebullition.

2. Acid solutions of As_2O_3 , where a large excess of free acid is present, are scarcely affected by chlorate at 20°C., until after standing some hours; the reaction ensues completely on heating to ebullition for a minute, and completely in a few minutes' heating on a water bath.

3. Alkaline solutions of As_2O_3 (containing NaHCO_3 and free carbonic acid) are wholly unaffected by chlorate, either cold or boiling, even after several hours.

4. Acid solutions of potassium iodide (free from iodate). Iodine begins to separate even at 20°C. in a very few moments on addition of very little chlorate, and after some time much separates. Heated to 100° on the water bath, the whole of the chlorate becomes completely decomposed, after five minutes, in presence of sufficient free acid.

5. Alkaline solutions of potassium iodide are unaffected by chlorates even on long standing or long boiling.

CORRESPONDENCE.

THE ALKALI TRADE.

To the Editor of the Chemical News.

SIR,—By the aid of your valuable paper, I would be glad to ask your readers if any of them could advise me in a few law and other points connected with the alkali trade. I am the manager of works which are situated in a village, and though I know no preventable gas escapes, and the inspector gives us credit for a very complete condensation of muriatic gas at the condensers, still I am constantly annoyed by receiving complaints from persons living, or having works in the vicinity of ours. We have, like all other alkali and bleaching powder works, to cause a trifling unpleasantness for a short time, when running off our stills, but unlike many others we are situated in a populated neighbourhood, and still more unfortunately the still-house is placed next our neighbour's wall. I keep the nuisance at a minimum, but still I hear reports of action which make me desire to know (if any of your readers can kindly inform me), whether there is any law about a case of this description, where the gas causing the nuisance is not muriatic acid, and therefore does not come under the supervision of the government inspector. I would also like to know whether the inspector have any control over the muriatic gas that escapes from the furnaces, because it is well known that a close or "blind" furnace does not throw off its gas so well as an open one, consequently with a "blind" furnace there is a great deal more comes off a batch of "sulphides" when being drawn.—I am, &c.

"NUISANCE."

SPECIFIC GRAVITY PROBLEM.

To the Editor of the Chemical News.

SIR,—The following solution of the Specific Gravity Problem, proposed by your correspondent Henri du Chemin-croix, may satisfy him, although I do not bring it forward with the idea that there may not be a shorter way of solving it.

The question may be summarised thus:—

To 1,000 grains of liquid of Sp. Gr.	1.314
" " " "	1.000 are added
giving 1,000+x "	1.286
	Find x.

Now, the relation which subsists between these two groups of quantities is, that the sum of the products of the number of grains of the two liquids taken separately into their respective specific gravities is equal to the product of the number of grains of the two liquids taken together into the specific gravity of the mixture thus obtained. We have then—

$$1,000 \times 1.314 + x \times 1.000 = (1,000 + x) 1.286.$$

Simplifying this equation, we obtain—

$$0.286x = 28$$

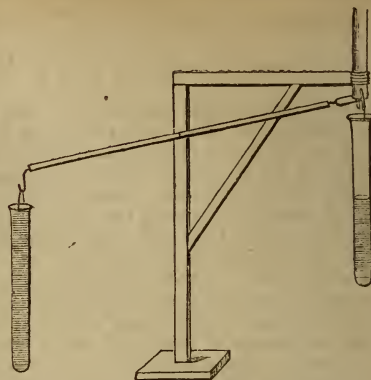
From which $x = \frac{28}{0.286} = 97.9$ grs. the quantity required

In conclusion, I may state that I tried this process with a solution of common salt, and arrived at a satisfactory result. F. J. R. C.

HYDROSTATIC PARADOX.

To the Editor of the Chemical News.

SIR,—The following simple experiment will illustrate the important principle of hydrostatic pressure; and I therefore take the liberty of sending it for the amusement of your readers.



Let two test-tubes of equal dimensions, one nearly full and the other about half full of water, be suspended at opposite ends of a beam, turning freely on a pivot, and let the second tube be so hung as to move in the same vertical straight line, during the vibration of the beam. Directly over this tube let a glass rod of smaller diameter be made to slide vertically through a fixed wire spring capable of holding it steady in any position. On lowering the rod carefully into the second tube so as not to touch its inner surface till the water therein is raised by displacement to the same level as that in the first tube, the two tubes will balance each other, though the original weight of water in each is different.

For if a be the area of the aperture of the tubes, h and h' the heights of the two columns of fluid, w the weight of a unit of water, and P , P' the pressures on the base, we shall have $P = wah$, and $P' = wah'$, the weight of water in the two tubes respectively. Therefore, when $h = h'$ we have $P = P'$.

If the glass rod had been suspended from the beam of a balance during the experiment, it would of course be found to have lost just the weight of the water displaced, or just the additional weight needed to counterbalance the full tube. This additional weight, so to say, was given to the second tube by means of hydrostatic pressure.

Instead of the glass rod a small cylinder of ice attached to a thin piece of wire may be employed, of such dimensions that, when the cylinder is entirely immersed in the water of the second tube, the fluid shall stand at the same level in both, and both be in equilibrium. Now, a given weight of water occupies less space than the same weight of part ice and part water. Consequently, as the ice melts, the column of fluid will sink in the second tube, and be unable to counterbalance the column in the first. The additional weight of water does not exactly replace the hydrostatic pressure withdrawn. The second tube will, therefore, rise.

If the balance be furnished with a long index, the movement will be more easily perceived, and curiously illustrate the different specific gravities of ice and water.—I am, &c.

EDWIN SMITH.

Nottingham, Sept. 2, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. June 17, 1867.

BECQUEREL, "On some new-discovered Chemical Effects of Capillary Action." A. DE LA RIVE, "Note on a Photometer for Measuring the Brightness of Distant Objects, and on the increased Transparency of the Atmosphere due to the Presence of Moisture." CHEVREUL, "On the same Subject." J. LEFORT, "Researches on the Chemical History of Humus." POOL, "Note on an explosive Compound obtained by treating Glue with Chlorate and Nitrate of

Potash." SILBERMANN, "On some Peculiar Phenomena observed in a Shooting Star on June 11, 1867." REBOUL and TRUCHOT, "On Ethylate of Amylene, an Isomer of Ethylamyl Ether; followed by some Remarks on the Production of Mixed Ethers." F. C. CALVERT, "On Oxidation by means of Oxygen condensed in Charcoal." LECOQ DE BOISBAUDRAN, "On some Experiments on Supersaturation." C. GIRARD and P. CHAPOTEAUT, "Contributions to the Knowledge of Ethers." E. MAUMENE, "Answer to Forthomme's Remarks on the Author's Paper on an Improved Fermenting Vat." DUBRUEIL and LEGROS, "Researches on the Physiological Action of Sulpho-cyanide of Potassium."

June 24, 1867.

ARTUR, "On Becquerel's Memoir on the Chemical Effects of Capillary Action." ZALIWSKI-MIKORSKI, "On the Effect of increasing the Height of the Elements of a Voltaic Battery, the Base remaining unchanged." "An Improvement in the Bunsen Battery." A. BAUDRIMONT, "On the Estimation of Organic Matter, Phosphoric Acid, and Nitrogen in Peruvian Guano and other Manures." EULENBURG and GUTTMANN, "On the Physiological Action of Bromide of Potassium." J. PERNOD, "On the Preparation of Madder for Calico Printing in the Topical Style." CHEVREUL, "on the same Subject." C. FRIEDEL and A. LADENBURG, "On a Silicic Mercaptan." R. D. SILVA, "On Compound Ammonias with an Amyle Base." JANSSEN, "On the Composition of the Gases emitted from the Volcano at Santorin."

Vol. 65. No. 1. July.

A. GAUDIN, "On the Special Function of Hydrogen in Acids, and particularly in Polybasic Acids."

Monatsbericht der königlich-Preussischen Akademie. March, 1867. W. KUHN, "On the Digestion of Albuminous Substances by the Pancreatic Juice." POGENDORFF, "On the Use of Paper Pyroxylin as an Electroscope." G. ROSE, "On the Formation of Crystals in Beads of Borax and other Blowpipe Re-agents, regarded as the Cause of the Opacity of such Beads when allowed to cool." "On the Preparation of Anatase and the other Allotropic Forms of Titantic Acid."

Annales de Chemie et de Physique. May, 1867.

G. A. HIRN, "Memoir on Thermodynamics. E. P. BERARD, "Letter to Dumas on the Invention of a Furnace for the Continuous Combustion of Sulphur in Sulphuric Acid Chambers. S. M. JOERGENSEN, "On the Periodides of the Alkaloids."

June.

B. RENAULT, "An Experimental Verification of the Reciprocal of Faraday's Law of the Decomposition of Electrolytes. A. SCHEURER-KESTNER, "Some new Researches on the Theory of Leblanc's Process for the Manufacture of Soda."

Annales du Génie Civil. June, 1867.

E. FERRAND, "On the History, Preparation, Properties, Action on the Workmen employed in the Manufacture and Applications of Coal Tar Dyes." GRIESS, "On Chlorochromate of Diazobenzide, a new Explosive Compound." FORTIER and PHILIPPE, "On the Use of Carbonate of Ammonia for Washing Wool and Cloth."—"On a Method of Renovating Files by Etching with Sulphuric Acid."—"On a new Fuel for Steam Engines, consisting of Peat saturated with Petroleum."

Le Technologiste. June, 1867.

H. WAGNER, "On a new Method of treating poor Copper Ores in the Wet Way. P. LE GUEN, "On a Method of Alloying Bessemer Steel with Tungsten." L. JOULIN, "On the Deposits of Potash and Soda Salts at Stassfurt." A. SCHEURER-KESTNER, "Some new Researches on the Theory of Leblanc's Process." F. STOLBA, "On the Preparation of Sulphurous Acid. E. GOSTMANN, "On the use of Paraffine for checking the Violent Ebullition of Syrup in Evaporating and Vacuum Pans." H. A. ARCHEREAU, "A Method of Manufacturing Oxygen by decomposing Sulphuric Acid, and on using the Gas produced, in Combination with Hydrogen, for Illuminating Purposes. C. PUSCHER, "On the Manufacture of Artificial Meerschaaum and Horn." A. PARAF, "On the use of a Glyceric Ether in Dyeing." DE LAIRE, C. GIRARD, and CHAPOTEAUT, "On Mauv-aniline, a new Coal Tar Dye."—"On a Method of Dyeing Sewing Silk Black." C. JACOBSEN, "On a new Marking Ink prepared from Aniline." C. LIEBERMANN, "On a Method of Distinguishing Wool and Cotton in Fabrics and Threads." C. WINKLER, "A Process for Purifying Graphite."

NOTES AND QUERIES.

Table of Densities.—If your correspondent, G. K. Bowtiff, meets with any difficulty in finding a table giving the weight per cubic inch of sulphuric acid at the different specific gravities, he may very easily prepare one by multiplying each specific gravity by 16.358 (the weight in grammes of one cubic inch of water at 16.7° C), and each result will be the weight in grammes of 1 cubic inch of acid for that specific gravity. Of course, if the result is required in grains, the multiplier will have to be 252.45.—F. J. R. C.

Testing Cognac.—In answer to your correspondent, C. Campbell, I beg to state that the aroma left on slow evaporation of genuine spirits when gently evaporated in the hollow of the hand is so very characteristic that it is used as a criterion in the South of France to distinguish pure *esprit de vin*, *esprit de marc de raisin*, and the spirituous fluids obtained from grain and beet-root. It is impossible

to entirely eliminate from the latter the fusel-oil, but this is never present in spirits made from wine, which, on the contrary, always contain small quantities of *enanthic* and *acetic* ethers. The smell left on evaporation of spirits not made from wine is so peculiar that it may be even recognised in the ether made from this spirit. Since the ravages occasioned by the grape-disease it will be difficult to procure from France or Spain really genuine spirits, unless specially ordered. The largest distillery in the United Kingdom is almost entirely employed making whiskey for exportation to France. I should say that the ripeness of the wine, its age, the grapes it was obtained from, and the whole process of fermentation, leave an indelible impression on the quality of the spirits obtained. From my own experience, I think it is hardly likely that Mr. Campbell will be able to find a chemical test for the purpose alluded to.—DR. ADRIAN.

TO CORRESPONDENTS.

* * * Owing to the non-arrival of our French Correspondence up to the time of going to press, we are unable to give this week our usual Reports on the Paris Exhibition, the Academy of Sciences and Foreign Science.

F. J. R. C.—Received with thanks. We shall always be glad to hear from this correspondent.

J. H. Mann, Polytechnic Institute, Troy, New York.—Communication received. The offer came to us through an unimpeachable channel, but, owing to the sudden decease of the gentleman entrusted with the negotiation, the matter is in abeyance. We will therefore hold the communication at our correspondent's disposal, to be either published or returned to him, unless in the meantime we can forward it to the proper quarters.

J. P. O'Brien.—We cannot undertake private negotiations for the sale of chemical works.

Ignoramus.—Nothing whatever is known about the cause of the transparency of metallic particles in solution. Your theory is certainly wrong. Take our advice; avoid theories for the present. Hear what Sir Humphry Davy said:—"When I consider the variety of theories which may be formed on the slender foundation of one or two facts, I am convinced that it is the business of the true philosopher to avoid them altogether. It is more laborious to accumulate facts than to reason concerning them; but one good experiment is of more value than the ingenuity of a brain like Newton's."

Querist.—Our printer will give you an estimate. If you want separate copies of your article you should mention it when you return the proof to our office. It is too late to wait till the *CHEMICAL NEWS* is published, as the type is distributed on Friday afternoon.

Thomas MacFarlane.—We doubt if a minute description of your system would be admitted to competition if it is only a trifling modification of the process in ordinary use. We imagine that an entirely new process is wanted; there is, however, no harm in trying

V. Cruise.—We regret we cannot give the information required.

D. J. O.—You can get the journals at Asher's, Bedford Street, Covent Garden, or Baillière's, Regent Street.

Rusticus.—1. There is no special memoir that we know of on the subject of nitro-glycerine as an explosive agent. 2. Larkin's magnesium powder lamp is the best.

F. J. Booth.—The camphor weather-glass is only a toy. In your question about the density of the air you put cause for effect.

E. Smith.—The article is received with thanks.

J. Fordine.—An article on the subject will soon appear. We are waiting for the report of the scientific examiners of the foul atmosphere of the railway.

Ellen G.—Tea is not adulterated to the extent you suppose. Your suspicions in the present instance are quite unfounded, as the sample sent us is quorum colouring matter.

Communications have been received from T. Hill; J. Thorley; F. J. R. Carulla; W. Procter, Junr.; T. G. Wormley; M. D. (with enclosure); W. J. Russell; G. F. Rodwell; J. Attfield; Rev. R. Harley, F.R.S.; A. E. Sansom, M.D.; J. Cliff; J. P. O'Brien; T. J. Barker (with enclosure); W. Lawrence; H. Bedford (with enclosure); R. Ward; C. J. Ellam (with enclosure); J. E. Wright; John Brown; Dr. Adiani (with enclosure); H. Armstrong (with enclosure); Henry Denny; J. Spiller; Lewis and Son; Robert Harley; C. L. Lee (with enclosure); P. W. Hofmann (with enclosure); E. Corbett, junr. (with enclosure); W. E. Bickerdike, F.R.S.; John Heywood; Peter Squire; E. Kienmann; John W. Burton (with enclosure).

Books Received.—"Micro-chemistry of Poisons, including their Physiological, Pathological, and Legal Relations."—By Thos. G. Wormley, M.D., with "Atlas" for the same, containing 78 illustrations upon steel. Baillière Brothers, New York. "Thorley's Illustrated Almanack."

St. Mary's Hospital Medical School, London.

The Introductory Lecture, by DR. BROADBENT, October 1st., at 8 p.m.

MEDICAL OFFICERS AND LECTURERS.—Consulting Officers: Dr. Alderson, F.R.S., Dr. Chambers, Mr. Coulson, Mr. White Cooper. Physicians: Dr. Sibson, F.R.S., Dr. H. Jones, F.R.S., Dr. Sieveking, Dr. Markham. Assistant-Physicians: Dr. Broadbent, Dr. Cheadle, Dr. Bastian. Surgeons: Mr. Lane, Mr. Spencer Smith, Mr. Haynes Walton, Mr. J. Lane. Assistant-Surgeons: Mr. Gascoyen and Mr. Norton. Physician-Accoucheur: Dr. Tyler Smith. Ophthalmic Surgeon: Mr. Ernest Hart. Surgeon-Dentist: Mr. Sercombe. Other Lecturers: Dr. Matthiessen, F.R.S., Dr. Randall, Dr. Lawson, Mr. Mivart, Dr. Trimen.

The course of teaching at this School includes adequate preparation for all the Examining Boards and the Public Services, and the higher University Examinations. Special instruction is provided (by separate courses) in Minor Surgery and Bandaging, Ophthalmic and Dental Surgery, Comparative Anatomy, and Mental Diseases. The Clinical System is carefully organised in the general wards, there are also departments for Diseases of Women and Children, of the Eye and Ear, of the Skin, and of the Throat. The scientific teaching is mainly demonstrative. All the resident medical appointments (including the House-Surgeons) are open to the Pupils without expense of any kind, and are equivalent to Five Scholarships of the annual value of Fifty Pounds. The Resident Registrarship is of the value of £100 a year, with board and lodging. Two Scholarships of £25 and £20 each, and Prizes in each group of classes, are awarded annually. The Prospectus, with addresses of Professor Owen and Huxley, the Archbishop of York, and Dr. Alderson, President of the College of Physicians, may be obtained on application to

ERNEST HART, Dean of the School.

University of Edinburgh.

The SESSION will commence on Monday, Nov. 4th, 1867.

FACULTY OF MEDICINE.

Diætics, Materia Medica, and Pharmacy ..	Mon., Nov. 4, 9 ..	Prof. Christison, M.D., 40, Moray-place.
Chemistry	Mon., Nov. 4, 10 ..	Prof. Lyon Playfair, C.B., 14, Abercromby-place.
Surgery	Mon., Nov. 4, 10 ..	Prof. Spence, 21 A Ainslie-place.
Institutes of Medicine ..	Mon., Nov. 4, 11 ..	Prof. Bennett, M.D., 1, Glenfinlas-street.
Midwifery and Diseases of Women and Children	Mon., Nov. 4, 11 ..	Prof. Sir J. Y. Simpson, Bart., M.D., 52, Queen-street.
Clinical Surgery (Mon. & Th.)	Mon., Nov. 4, 12 ..	Prof. Syme, 1, Shandwick-place.
Clinical Medicine (Tu. & Fr.)	Tues., Nov. 5, 12-2 ..	Profs. Bennett, Laycock, and MacLagan.
Anatomy	Mon., Nov. 4, 1 ..	Prof. Turner, M.B., 7, Brunswick-street, Hillside.
Natural History	Mon., Nov. 4, 2 ..	Prof. Allman, M.D., 21, Manor-palace.
Practice of Physic	Mon., Nov. 4, 3 ..	Prof. Laycock, M.D., 13, Walker-street.
General Pathology	Mon., Nov. 4, 4 ..	Prof. Henderson, M.D., 19, Ainslie-pl.
Anatomical Demonstrations	Mon., Nov. 4, 4 ..	Prof. Turner.

ROYAL INFIRMARY at Noon, Daily.

Practical Anatomy, under the superintendence of Professor Turner.

Practical Chemistry, under the superintendence of Professor Lyon Playfair.

Analytical Chemistry, under the superintendence of Professor Lyon Playfair.

Practical Physiology, under the superintendence of Professor Bennet.

MATRICULATION.—Every Student, before entering with any Professor, must produce a Matriculation Ticket for the ensuing Session. Tickets will be issued at the Matriculation Office, at the College, every lawful day, on and after 7th October, from ten till four o'clock. Enrolment in the General Album is the only legal record of attendance in the University.

LIBRARY.—The Library will be open for the purpose of giving out Books to Students, either on loan, or for reference in the Hall appropriated for that purpose, every lawful day during the Winter Session, from ten o'clock A.M. till four o'clock P.M.; except on Saturdays, when it will be shut at one o'clock precisely.

Every Student applying for Books must present to the Librarian his Matriculation Ticket for the Session, with the Ticket of at least one Professor.

Every Book taken out must be returned within a fortnight, uninjured.

N.B.—Information relative to the Curricula of Study for Degrees, Examinations, &c., will be found in the University Calendar, and may be obtained on application to the Secretary at the College.

A Table of Fees may be seen in the Matriculation Office, and in the Reading-room of the Library.

By order of the Senatus,

PHILIP KELLAND, Sec. to the Senatus.

14th September, 1867.

City of London College, Leadenhall Street.

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THE CHEMICAL NEWS.

VOL. XVI., No. 409.

ON SOME POINTS IN CHEMICAL GEOLOGY.

By DAVID FORBES, F.R.S., &c.

It must be admitted that the study of geological chemistry has more particularly of late years met with but little attention from British chemists; this apparent neglect, however, cannot be attributed to any want of appreciation of the importance of this branch of the science, but is rather due to the greater attractions possessed by the more novel and extensive field of exploration now opened up by the rapid strides of organic research, which appears to have all but absorbed the supply of labourers in the domain of chemical science.

The appearance in a late number of this periodical of a somewhat lengthy communication on chemical geology, was hailed by the author of these remarks with much pleasure, and as he has already long devoted himself to similar inquiries, and believes that a little discussion on the subject might prove useful in exciting afresh the interest of those familiar with this branch of the science, and might assist in arousing the study of chemical geology from its present semi-torpid state in England, does not consider further apology necessary for laying before the chemical public some observations upon the theoretical views in geological chemistry recently propounded by Dr. Sterry Hunt,* which are at considerable variance with those hitherto generally accepted by those chemists who have more specially studied this branch of the science.

In the *Geological Magazine* for this month the author has treated of the same subject more from a physical and geological point of view, and therefore will in the present communication as much as possible confine himself to a more purely chemical examination of the arguments and data brought forward by Dr. Hunt in support of his propositions.

In explaining the origin of this globe, Dr. Hunt adopts the nebulous hypothesis, imagining the whole of the chemical elements now constituting its mass, to have been originally present as "dissociated" gases, in a state of chemical "indifference" to one another, due to the intensely high temperature to which he supposes them to have originally been exposed. A lowering in temperature is then assumed to have brought about the chemical combinations of these elements, and the subsequent condensation of their compounds into the form of a sphere of igneous fluid matter surrounded by a dense gaseous atmosphere.

The old hypothesis of Davy assumed a similar result as being due to the heat eliminated by the combination of the elements themselves; but in Dr. Hunt's lecture he does not explain how he imagines the intense heat which originally caused the elements to become "dissociated and indifferent" to have arisen.

According to Dr. Hunt, this igneous sphere when cooling commenced to solidify at its centre, and extended outwards towards its exterior so as to produce a globe solid to the core, his words being, "The cooling in a mass like this would be just like the cooling of a great bath of metal or sulphur—i. e., in other words, the condensation or congelation would commence at the centre and extend outwards towards the surface."† It is almost superfluous to observe that everyone knows that this is not

the case with either sulphur or metals when cooling under ordinary circumstances; for chemists and others are accustomed in preparing crystals of sulphur or metals to allow such a melted bath to cool until its exterior has alone become solidified, and then, after making an orifice through the crust to pour out the still fluid central mass, which consequently has not solidified first.

Dr. Hunt, however, explains that in the case of a cooling globe the central part would solidify first, owing to its melting point being much more elevated by the pressure to which it was subjected, and appeals to experiments of the late Mr. Hopkins‡ as conclusive proof that the melting points of bodies do become (*ad infinitum*) elevated in proportion to the applied pressure.

Without disputing that the fusing points of many bodies may be elevated by pressure, a reference to the experiments appealed to by Dr. Hunt will show that (in the present instance at least) they are not at all conclusive. Setting aside the experiments made on spermaceti, stearine, and wax, which being organic substances decomposed at comparatively low temperatures, and possess no analogy whatever to the mineral compounds here under consideration, the other experiments of Mr. Hopkins were made on sulphur and metallic alloys, and consequently their results should be particularly applicable to the case of a "bath of metal or sulphur," alluded to as a simile by Dr. Hunt. On reference to the report in question, however, it will be at once perceived that the result of these experiments cannot at all warrant deductions so conclusive as Dr. Hunt has drawn from them; for Mr. Hopkins expressly states that in the case of the metallic alloys experimented upon, "he has not detected any elevation of fusing temperature acquired by increasing the pressure." Again, the experiments made with sulphur afforded the following results:—

Pressure in atmospheres.	Pressure in lb. per square inch.	Fusing point in Centigrade.
1	15	107.2
520	7,790	135.2
793	11,990	140.5

In other words expressed, these figures show that the melting-point of sulphur under a pressure varying from 1 to 520 atmospheres, becomes elevated in temperature at the rate of 0.0394° Centigrade per atmosphere of applied pressure, but that subsequently up to 793 atmospheres, the highest pressure employed in these experiments, this rate diminished greatly, becoming little more than one quarter of the previous rate of increase, or only 0.0101° Centigrade for each atmosphere. It may not unreasonably be supposed, therefore, that greater pressure would still further lower this ratio, and eventually reduce its fusing-point once more to the temperature at which it melts when not subjected to any pressure; and it may even be imagined that subsequently, as in the case of water, a still higher pressure might actually cause depression instead of elevation of its fusing-points.

It is admitted now that there is a limit to the increase in density of bodies when subjected to pressure, or rather that after a certain point is reached that the increase of density of a body bears a less and less ratio to the actual compressing force employed; and it may be imagined that the same result would be also found to take place in the relations of the increase in temperature of the fusing-points of bodies to the pressure applied. It seems not improbable even that substances when once brought to the condition of maximum density might not then have the temperature of their fusing-points further elevated by increase of pressure.

Whether this be or be not the case, however, Dr. Hunt's argument would not be valid unless he at the same time brought forward proof that the substance of the earth is homogeneous throughout, or made up of substances possessing the same or nearly the same fusing-points as that of the original external crust or layer. Now, there seems

* Dr. Hunt's *resumé* of his lecture, "On the Chemistry of the Primeval Earth," *CHEMICAL NEWS*, vol. xv., pp. 315—317; short-hand verbatim report of same in *Geological Magazine*, vol. iv., pp. 357—369, containing more details than the above abstract; also Dr. Hunt's communications to the *Académie des Sciences*, 22nd April, 1867, noticed in *CHEMICAL NEWS*, vol. xvi., p. 148.

† *Geological Magazine*, vol. iv., p. 361.

‡ British Association Report, 1854, page 57.

no grounds for believing that such can be the case; for since the mean specific gravity of the earth is about double that of the substances composing its known exterior crust, it would appear all but certain that the interior mass must be composed of substances different in composition, and much more dense than those known to form the superficial parts of the globe;|| and this would indicate the great probability of there being in the interior of the earth an immense accumulation of metallic bodies of great density; and as the fusing points of such substances are acknowledged to be immensely lower than that of those composing the known crust of the earth, it might be advanced in opposition to Dr. Hunt's views that this difference would more than counterbalance the tendency to solidify at the centre in the case of the fusing points being really even considerably elevated by the effects of pressure.

For these and many other reasons, some of which will be afterwards noticed in the course of this discussion, the author cannot agree with Dr. Hunt that the earth is solid to the core, but believes that there is still some vast reservoir or reservoirs of molten matter in its interior.

In entering into the consideration of the chemical history of the earth from the moment of solidification Dr. Hunt now bases the whole of his views of the reactions and the entire exposition of the chemical changes which took place in this newly-created globe upon the constitution of the atmosphere with which it then was surrounded; it consequently becomes of the highest importance to ascertain by careful scrutiny as to whether his views upon this subject are sound and likely to meet with acceptance in the chemical world.

This atmosphere according to Dr. Hunt was intensely acid and of great density, and contained all the carbon, sulphur, and chlorine in combination respectively, as carbonic, sulphurous and hydrochloric acids along with the nitrogen, steam, and "a probable excess of oxygen."

That the nitrogen, steam, and carbonic acid would be there is readily admitted, but it may fairly be inquired whether any chemist can believe, that after the grand scene of general combination of the elements occurring under the circumstances assumed by Dr. Hunt, that (even if possible?) it could be at all *probable* that an *excess of oxygen* could exist along with the vast amount of sulphurous acid which was present, if that gentleman's premises were correct. Further, the improbability of such an atmosphere containing a mixture of heated hydrochloric and sulphurous acid gases, may be inferred from Dumas' researches;§ that chemist having long ago shown that these gases when mixed together, react and mutually decompose one another with the formation of water, chlorine, and sulphur.

The strong affinity which sulphur has for the metals is well known, as also the fact that sulphurous acid is itself readily decomposed by many metals, with the formation of metallic sulphides and oxides; and the inference which the author would deduct therefrom is that so far from all the sulphur having at this crisis of chemical combination gone into the atmosphere as sulphurous acid, it in reality united itself to the metals, and thus formed dense sulphides which at once sunk through the external and lighter fluid layer of the still

liquid igneous sphere, and there remained in its interior protected from oxidising action.

The existence in Dr. Hunt's imaginary atmosphere of all the chlorine in the form of hydrochloric acid is also protested against. Independently of the probability of in such event the oxygen and hydrochloric acid gas reacting upon one another, and reproducing chlorine with the vapour of water; it is contended, that hydrochloric acid was not even likely to have been formed at all under the circumstances here alluded to. Amongst the most stable, if not the most stable of all the compounds of chlorine are the alkaline chlorides—for example, chloride of sodium or salt, and it may be gathered from Dr. Hunt's lecture that he cannot but admit that there must have been abundance of metallic sodium present at the moment of the general combination of the chemical elements. Chemists therefore will require of Dr. Hunt an explanation as to why he in such a case, supposes the chlorine to have united itself with the hydrogen to form hydrochloric acid, instead of at once combining with the equally accessible sodium, for which chlorine is known to possess a stronger affinity than for hydrogen; chlorine unites even at ordinary temperatures and without compulsion directly with sodium, and still more energetically at more elevated temperatures; and that its affinity for sodium is far stronger than for hydrogen is shown by the fact that hydrogen does not decompose chloride of sodium even with the assistance of heat, whilst, on the contrary, the chloride of hydrogen or hydrochloric acid is decomposed and yields up its chlorine to the sodium and various other metals, even in the cold.

When summing up the arguments advanced on both sides, as to the constitution of the atmosphere which enveloped the earth at this early period of its existence, the writer confidently believes that chemists will agree with him in disputing the probability and even possibility of such a chlorhydric and sulphurous atmosphere as Dr. Hunt has attempted to realize, and thinks with him that the main differences between the air of that period and the present age would be in the large quantity of carbonic acid and water, along with probably a much less amount of oxygen.

To elucidate the chemical reactions which characterised this stage of the earth's history, Dr. Hunt states that they were "just what would now result if the solid land, sea and air were made to react upon each other under the influence of intense heat"; it is well known that temperature may greatly modify chemical action, but as Dr. Hunt's ultra-igneous theory* deals with the effects of heat so immensely intense as to "dissociate" and vaporize even the most refractory bodies, it must be admitted that his comparison is quite correct, but at the same time it is not admitted that the results of such reactions would be such as Dr. Hunt represents them to be when he states, "to the chemist it is at once evident that from this would result the conversion of all carbonates, chlorides, and sulphates into silicates, and the separation of the carbon, chlorine, and sulphur in the form of acid gases"; on the contrary the author believes that the chemist who knew anything about geology would remember the vast stores of carbonaceous matter locked up in the earth's bowels, and deduce therefrom that the carbon of these would react upon the sulphates, converting them into sulphides without their evolving all the sulphur they contain in the form of acid gas, as Dr. Hunt would have us to believe—nor would he admit that all the chlorides were converted into silicates, or that as Dr. Hunt elsewhere† tells us that the chlorine of the sea-salt would be expelled into the atmosphere in the form of hydrochloric acid gas; for although

|| Knowing that there is a limit beyond which substances increase but little in density when subjected to additional pressure, it may fairly be assumed that the materials of the known external crust would have attained their maximum density long before the conditions here required would have been arrived at; a simple calculation will show that if we regard the mean density of the earth as 5·3 and that of the surface crust as one half this, or 2·65, and further imagine the earth to be composed of three concentric layers of equal thickness, and of densities increasing respectively in arithmetical progression, there would be respectively an outer crust of specific gravity 2·65, an intermediate zone of specific gravity 10·7, and a central kernel of specific gravity 18·8. If instead of three such zones, more than this number are imagined, then the calculation will show that the specific gravity of the central kernel will come out still higher than 18·8.

§ *Traité de Chimie*, t. i. p. 146.

* The idea of igneous action propounded by Hutton and his followers the Plutonists, is but a milk-warm theory when compared to that of Dr. Hunt, who whilst protesting against the earth having been formed "entirely by fire," discourses eloquently on its creation from a state of ultra incandescence at temperatures so elevated as would have been far beyond the conception of Hutton himself.

† *Geological Magazine*, vol. iv. p. 362.

he would be fully aware that silica, sea-salt, and water if exposed to heat under forced circumstances, as for example when heated in confinement or when the vapour of water and salt be passed over highly heated silica, that in such case silicate of soda would be formed and hydrochloric acid evolved; this, however, would not be the case in nature in the event alluded to by Dr. Hunt, for the water in the sea would be all evaporated at the first approach of the heat, leaving the anhydrous salt, which, being also volatile, would be next sublimed as soon as the heat became more intense; the unaltered quartz remaining behind, before it had even attained a temperature sufficient to have effected the supposed reaction.

The sea, which would cover the earth's surface as soon as this had cooled down sufficiently to allow of the condensation of the vast accumulation of aqueous vapour in the atmosphere, would, the author believes, become salt the moment it appeared upon the surface of the globe, since the water would at once dissolve the chlorides formed by the direct combination of the metals with chlorine, as previously alluded to, and thus produce a solution of the chlorides of sodium, potassium, calcium, magnesium, &c., along with iodides and bromides which owed their origin to similar reactions. As Dr. Hunt does not attempt to explain why the chloride of sodium should so preponderate over that of potassium or the other alkalies, this question may be reserved for future research and speculation.

Dr. Hunt however accounts for the saltiness of the sea by an explanation totally different from the above, and after stating that "the depressed portions of half cooled crusts would be flooded with a highly heated solution of hydrochloric acid," proceeds to inform his audience that this acid deluge would extract the soda along with some other bases from the silicates of the crust, and thus form the salt sea.

Should chemists, however, adopt the author's opinion that the chlorine really had at once united with the sodium to form salt and other chlorides, then it naturally follows that Dr. Hunt's views of this stage in the earth's history are untenable.

For the sake of argument, however, let it be supposed for a moment that Dr. Hunt is correct in insisting upon that all the chlorine and sulphur had ascended into the atmosphere as acid vapours; then it must be asked, What became of the sulphur? As Dr. Hunt did not inform his audience in his lecture, we must inquire ourselves. The sulphurous acid would naturally convert itself sooner or later into sulphuric acid, and would be condensed and fall down on to the globe, and be carried into the sea.

As now, sulphuric acid is more powerful than hydrochloric acid, it would at once turn out the hydrochloric acid, and convert the chlorides into sulphates, so that, instead of the ocean formed by Dr. Hunt's theory being a salt sea in the ordinary acceptation of this term, it would really be a solution of glauber-salt or sulphate of soda.

There are many reasons for estimating the probable quantity of sulphur contained in the globe as fully as large, if not larger, than that of chlorine; but as the equivalent of sulphur is only 16, whilst that of chlorine is 35.5, it would not require as much sulphur as even one-half the amount of the chlorine present in the sea to convert the entire amount of salt contained in the ocean into sulphate of soda.

Dr. Hunt next makes the surprising assertion that all true limestones are the result of the precipitation of carbonate of lime thrown down from a solution of the chloride of calcium by the action of solutions of carbonate of soda. As Dr. Hunt does not in his lecture advance any evidence whatsoever in support of this statement, it is considered to be purely hypothetical; and it is believed that chemists will still adhere to the opinion that limestones have not been so found, but that they are essentially the result of organic action, as has been very satisfactorily demonstrated by the careful study already

made of these rocks by geologists, palæontologists, and microscopists.

It is not probable that either chemists or zoologists will agree with Dr. Hunt's further assertion that "animals can only appropriate the carbonate of lime which they find ready formed," but that they will consider these animals capable of utilising the other lime salts in the sea until, at least, Dr. Hunt brings forth convincing evidence to the contrary.

Sorby's admirable microscopical investigations have clearly demonstrated that the magnesian limestones and dolomites in reality only represent ordinary limestone beds, altered *in situ* by the infiltration of magnesian solutions. Dr. Hunt, on the contrary, claims to have discovered that magnesian limestones, dolomites, and gypseous beds have originated through chemical "reactions hitherto unsuspected," and that his experimental researches have proved them to have been formed at a time when the surface of the earth was covered by a dense atmosphere of carbonic acid. In reply to Dr. Hunt, the author would, in plain words, declare his firm belief that geologists, palæontologists, or zoologists will be as little disposed to consider his conclusions even likely to be true, as chemists on the other hand will admit his reactions and experiments to be new.

The former will content themselves with informing Dr. Hunt that every geologist should be aware that the great development of such beds took place at an epoch in the world's history, when air-breathing animals, (both vertebrate and invertebrate), lived upon the face of the earth, and with expressing their surprise that Dr. Hunt could imagine these animals living in an atmosphere of carbonic acid; whilst chemists, on their part, would not be disposed to regard the mutual reactions of the sulphate or chloride of magnesium with carbonate of lime, as possessing novelty, and would further inform Dr. Hunt that, notwithstanding he has considered the results of his experiments on magnesian compounds under an artificial atmosphere of carbonic acid as worthy of being laid before the *Académie des Sciences* of Paris,* that for nearly, if not more, than a quarter of a century these very processes have been in general application on the large scale in the manufacturing of preparations of magnesia both in England and Ireland.

In concluding these remarks, the author can only but record his protest against the soundness of the arguments propounded by Dr. Hunt in his explanation of the origin of granite and the formation of the metamorphic and eruptive rocks, both ancient and modern, as in this present communication the space at disposal will not allow of more extended discussion. On some future occasion, however, an attempt will be made to take the chemistry of the formation and alterations undergone by these rock-masses also into consideration.

Quekett Microscopical Club.—The monthly meeting was held at University College, on Friday evening, September 27, Mr. A. E. Durham, President, in the chair. Mr. Glade read a paper on "snails teeth," in which he described those organs of mollusca known as the tongue or palate, consisting of a long and narrow strip of membrane on which are arranged, in various patterns, successive series of strong recurved teeth, by the rasping action of which the animal is enabled to obtain its food. By this means the carnivorous mollusca bore through the shells of the animals on which they prey. The numbers, arrangement, and shape of these teeth afford to naturalists a means of determining species. Dr. Maddox exhibited a collection of beautifully executed micro-photographs of deep sea soundings, many of the objects being magnified 3,000 times.

* *Comptes Rendus*, April 22, 1867, lxiv., p. 815.

ON THE COMMERCIAL ANALYSIS OF SOME OF
THE PRODUCTS AND MATERIALS OF THE
ALKALI MANUFACTURE, &c.

By C. R. A. WRIGHT, B.Sc., F.C.S.

(Continued from page 171.)

Where the hypochlorite contained in a sample of bleaching powder, which may also contain chlorate, is to be determined, the only safe and convenient method is that of Penot, *i. e.*, by the use of an alkaline solution of As_2O_3 . When the chlorate likewise is to be determined, it may be expeditiously done by heating the sample with a known quantity of the same arsenite solution, and addition of HCl ; from the difference between the quantities of arsenite peroxidised in the two instances the chlorate is readily known. The writer has found bleaching powder of commerce to contain several per cents of calcium chlorate, even when newly made; in older samples the chlorate has been occasionally found to represent as much as 10 per cent of available chlorine, or fully one-fourth of the amount originally present; thus indicating overheating either in the process of manufacture or subsequently.

(V.)—Manganese Ore.—The mode of analysis of manganese ores usually adopted is that of Fresenius and Will, viz., estimation of the CO_2 evolved by acting on an oxalate in presence of SO_4H_2 . Although capable of yielding the most accurate results, this process is usually misapplied in such a way as to indicate 2, 3, and more per cents of "available binoxide" over and above that really present. In order to shorten the time requisite for analysis the apparatus, weighed cold previously to the expulsion of CO_2 , is usually weighed whilst quite hot the instant the reaction is complete; thus errors of varying amount are introduced, the apparatus always appearing to weigh less while hot than when cold on account of the effect of the ascending current of warm air buoying up the scale-pan, &c.; the writer has found differences of from 1 to 3 per cent between the results obtained by weighing the apparatus while quite hot, and those got by allowing it to cool completely before weighing. Again, many kinds of manganese ore contain perceptible quantities of carbonate in the gangue, and frequently the commercial analyst does not take the trouble to estimate and subtract the CO_2 evolved from this source. Through haste, also, the CO_2 may be liberated too rapidly to get perfectly dried before escaping from the apparatus. Lastly, the CO_2 evolved is considered to represent the available MnO_2 present, whereas it represents $\frac{2}{3}$ of that amount, 55 being the generally admitted equivalent of manganese. From one or all of these reasons it is by no means unfrequent to find the percentage reported by a commercial analyst 4 or 5 per cent above what is really present; a matter of considerable importance to the purchaser who pays according to the certificate of analysis. Practically speaking, therefore, volumetric methods requiring less time or attention on the part of the analyst, are more likely to give correct results in cases where accuracy must be sacrificed to speed, which is too often the case when low fees are demanded for analytical work.

In order to compare the results obtainable by the better known processes for the valuation of manganese ores, the following methods were tried with the same sample of uniformly mixed finely powdered ore.

(1). Fresenius and Wills' process: oxidation of oxalate and estimation of CO_2 produced by loss of weight.

(2). Bunsen's process: distillation with strong hydrochloric acid and reception of chlorine evolved in potassium iodide solution, the liberated iodine being determined by hyposulphite of soda and standard iodine solutions.

(3). Mohr's process: distillation with hydrochloric acid, reception of chlorine evolved in an alkaline arsenite solution of known strength, and estimation of unoxidised arsenite by standard iodine solution.

(4). Price's process: boiling the ore with hydrochloric acid and a known amount of As_2O_3 , in a flask to which a bulb tube is attached to prevent the loss of AsCl_3 , estimation of unoxidised As_2O_3 by a solution of permanganate.

(5). Price's process modified: SO_4H_2 used instead of HCl , and accordingly an ordinary flask being used instead of the flask and bulb apparatus.

(6). Otto's process: boiling with a known amount of a ferrous salt, the excess of iron being determined by a standard solution of potassium di-chromate, or permanganate.

These methods gave the following results:—

	Name of method.	Percentage of available binoxide found.	Difference from mean.
(1).	Fresenius and Wills'	65.49	+0.04
	" 2nd experiment	65.43	-0.02
(2).	Bunsen's	65.41	-0.04
	" 2nd experiment	65.63	+0.18
(3).	Mohr's	65.46	+0.01
(4).	Price's	65.49	+0.04
(5).	" modified	65.60	+0.15
	" 2nd experiment	65.35	-0.10
(6).	Otto's	65.30	-0.15
	" 2nd experiment	65.36	-0.09
	Mean result	65.45	

In no case is there so great an error as ± 0.2 from the mean result. In point of speed Fresenius and Wills' is very good, but, as usually employed, is open to the objections previously stated; and when any carbonate is contained in the ore, requires a double estimation. Bunsen's and Mohr's are both speedy, but are troublesome in a commercial laboratory, and require accurate weighings on account of the small amount of substance taken. The latter objection also applies to Otto's process. Price's process and its modification are both open to the objection that permanganate does not act absolutely uniformly on As_2O_3 , and that a reddish manganic salt is produced by the reaction; for technical purposes, however, this error is rendered negligible by not taking a very large excess of As_2O_3 , and standardising the permanganate by an arsenious solution of known strength. In performing the process with SO_4H_2 , the weighed As_2O_3 should be placed in a flask, and boiled with sufficient pure sulphuric acid diluted with twice its bulk of water to dissolve it; the weighed manganese ore is then dropped in, and the whole boiled until no black specks of MnO_2 are visible. For every gramme of manganese ore of 70 per cent available peroxide 0.85 grammes of As_2O_3 is sufficient, leaving thus only a small portion of unoxidised As_2O_3 to be determined by the permanganate, which should be standardised by a solution of a known weight of As_2O_3 in sulphuric acid. If any considerable excess of As_2O_3 have been used it will be more convenient to dilute the acid fluid obtained after boiling with the manganese ore to a known volume—say 300 c.c.—and filter off an aliquot portion for titration by permanganate.

Occasionally, manganese ores contain admixtures of magnetic oxide of iron, ferrous carbonate, or other iron compounds not fully oxidised to the ferric state. Accordingly, when treated with hydrochloric acid, the chlorine given off will be a measure, not of the total MnO_2 present, but of that MnO_2 over and above what is requisite to peroxidise the ferrous compounds. In order to see how the presence of ferrous compounds affects Fresenius and Wills' process, known weights of pure $\text{FeSO}_4 + (\text{NH}_4)_2\text{SO}_4 + 6\text{H}_2\text{O}$ were treated along with weighed portions of the manganese ore previously experimented on in the CO_2 apparatus with the following results:—

	A.	B.	C.
Percentage of MnO_2 corresponding to the CO_2 evolved	62.62 ..	61.38 ..	45.46
" " Ferrous salt used	2.71 ..	4.14 ..	20.58
Total	65.33 ..	65.52 ..	66.40

It therefore appears that even when a considerable amount of ferrous compound is present the CO_2 evolved corresponds, as in the processes depending on the evolution of chlorine, not to the whole MnO_2 present, but to that left after the ferrous compound is oxidised. In the case of Price and Otto's processes the same will evidently be the case.

ON METEORS.*

By Professor ALEXANDER HERSCHEL.

A QUESTION which at present agitates the minds of physical astronomers is, to ascertain whether a slight acceleration of the moon's apparent motion can be attributed to a lurking error in the calculations of its place, or whether the earth, in the course of ages, has lost a small portion of its speed of revolution round its axis. The latter alternative would appear to explain the fact that the lunar tables, which exactly represent the moon's apparent motion at the present time, do not absolutely give the hour of the day of an eclipse which happened when the sun was setting at Babylon some hundred years before the Christian era. The eclipse began, according to the tables, when the sun was already below the horizon, and it would be invisible at Babylon. But if the earth's rotation, instead of being uniform, were a little more rapid in former times than it is at present, the sun, instead of being set below the horizon of Babylon, would appear eclipsed above it, as the phenomenon was in reality observed. To account for a slower rotation of the earth about its axis at the present time than that which it possessed formerly, the friction of the tides has been supposed to play an important part in checking its velocity. A slow accumulation of meteorites upon the earth's surface, although not appreciably altering the figure and dimensions of the globe, must yet, in the course of many ages, produce an average effect of diminishing its velocity of revolution. The change of a hundredth part of a second in the length of the day, since the time of the earliest observations, would explain the small error which astronomers have discovered, and the cause of which still eludes their search.

Damages to life and property by the fall of meteorites are, from the generally small size of aërolites, among the rarest catastrophes on record. Yet a Franciscan monk was struck and killed by an aërolite, at Padua, in the year 1660, and the Italian philosopher Zerkago, wonderfully concerned at the event, inquired if the stone could not have been projected from a volcano on the moon. At a later period of discovery with regard to meteorites, this conjecture received considerable support, but it was finally rejected as insufficient when it was found that aërolites move with velocities much greater than that of satellites of the earth.

In the year A.D. 1719, a meteor of unusual size appeared in England, to which trigonometrical calculation assigned a diameter of at least a mile, a velocity of three miles per second, and a height in the atmosphere of sixty geographical miles. A detonation like thunder shook the houses as it passed. Dr. Edmund Halley, who was then Professor of Astronomy at Oxford, described the appearance of this meteor. He held the opinion of Aristotle that the meteor was caused by the kindling of a tract of inflammable gas, collected in a long train at the top of the atmosphere, and there exploding. Aristotle's opinion cannot be entertained, on account of the rarity of the atmosphere at great heights being insufficient to support the vivid illumination of large meteors by simple inflammation and combustion of a gaseous mixture. It was, according to the opinion of

Dr. Wallis, who described an equally large meteor that passed over England at twilight on the 20th September, 1676, thought to be more probable that the fire-ball was a near view of a comet which was seen near the sun about a fortnight later. It deserves to be mentioned that Dr. Wallis occupied the same chair in the University of Oxford in which Dr. Baden Powell, who alone instituted and began the present series of reports of the British Association on luminous meteors, afterwards proved his illustrious successor, and that the views which Dr. Wallis first introduced on the subject of observations of luminous meteors to English readers have been singularly verified in the events of the past year. In the years 1758 and 1783 Dr. Pringle and Dr. Blagden, at that time the Secretaries of the Royal Society, described two of the largest meteors that appeared in the last century in England. Their calculated height in the atmosphere was about 50 miles, and they were accompanied, like that described by Halley, by very loud explosions. The discovery of atmospheric electricity had hardly been made when these two writers attributed the appearance of large meteors to the same cause as that which gives rise to lightning in the lower regions of the atmosphere. The character of the discharge of electricity in exceedingly rare gases was, however, beginning at the time to be studied, and Lichtenberg's experiments at Göttingen convinced Chladni at Wittemberg that the real explanation of fire-balls had not yet been discovered. In the Mineralogical Museum of St. Petersburg a large mass of metallic iron, weighing about seven hundred-weights, had been brought by Pallas, the geologist and explorer, from the summit of the hill of Krasnojarsk, in Siberia, where it was found. The origin of the mass was a vexed question with geologists when, in the year 1794, Chladni published his work on "The Iron Mass of Pallas, and on Other Masses of Iron and Stone Reputed to have Fallen from the Air." In this work Chladni supposes that all the accounts hitherto received of the falls of aërolites were correct, and he presents a catalogue of them, together with all the accounts of large fire-balls which he was able to collect. Chladni conceived that a class of cosmical bodies exists in all parts of the solar system, each forming by itself a peculiar concourse of atoms; and that the earth from time to time encounters them, moving with a velocity as great as its own, and doubtless in orbits of very various eccentricity round the sun.

Chladni further assumed that a certain property of compressed air, which can be readily exhibited by an instrument called a match-syringe, produces the vivid light and heat of combustion which these bodies exhibit when they are first brought into collision with the outer strata of the atmosphere. When air is confined by a piston in a tube, and the piston, carrying a piece of tinder or other light substance at the end, is suddenly forced into the tube, the heat developed by the compression of the air is so great as to ignite the tinder. The passage of a celestial body through the atmosphere must be intensely rapid, so that before the air can make its escape from the front of such a projectile, it must necessarily undergo a violent compression of the kind exemplified in the match-syringe—the heat developed on its surface must, doubtless, far surpass what can be produced by mechanical means. A series of accurate experiments was made by Dr. Joule, from which it may safely be concluded that a velocity of transit through the air, which is not uncommonly observed in meteors, of thirty miles in a second, would produce upon the surface of the meteoric body a heat sufficient to fuse, and probably also to volatilise, the most refractory substances. Not only the thin glazed surface or crust with which aërolites are invariably covered, but also the appearance of fire-balls and shooting-stars can be satisfactorily explained on these assumptions. Astronomical observations are only required to determine what is the real course of the meteoric particles in space; what is their law of distribution; what is the class of orbits which they pursue;

* From a lecture delivered before the British Association, at Dundee.

and finally, what is their history, either as independent bodies or as emissaries from the train of some other well-known bodies of the visible universe. The first astronomical observations of the kind necessary to confirm the theory of Chladni were those conducted by Brandes and Berzenberg, at Göttingen, in the year 1798, on the heights and velocities of shooting-stars. It was found that shooting-stars appear at a surprising height in the atmosphere, and move with the extravagant velocity which large aërolitic fire-balls were already known to have. The first indication was thus gained that shooting-stars are, in fact, pigmy aërolites, and that aërolites are a gigantic kind of shooting-stars. Observations of luminous meteors have now divided themselves into three classes, for each of which a separate investigation leads to the uniform result that the hypothesis of Chladni is the only one which bears upon its face the stamp of truth. In the principal division of the subject (to which Professor Maskelyne has given the name of aërolites), it was shown by Edward Howard, in the beginning of the present century, that meteoric stones differ essentially from terrestrial rocks, by abounding with metallic iron. But they agree among themselves, by having, in every case which he examined, the rarer metal nickel for an ingredient. Chromium was afterwards shown by Laugier to be an even more constant companion of iron in meteorites than nickel. Copper, tin, and lead, soluble chlorides of sodium and potassium, carbon, in the form of graphite, and once occurring as a carbonaceous peat-like mass, and in one other case as a volatile substance—have been found in meteorites; but no new element has been discovered which is not already known to exist upon the earth. Quite recently, the Master of the Royal Mint, Prof. Graham, has found an abundance of hydrogen gas occluded, or stored up, in the mass of a meteoric iron. The similarity of composition of all the members of the solar system receives from these discoveries an argument of credibility quite as strong, and, indeed, much stronger, than that which can be drawn from an examination of the sun's light in the spectroscopic; because, in the case of meteorites, bodies evidently belonging to the celestial spaces can be handled, and their materials have been freely analysed. Among the largest aërolite falls of modern times, two celebrated examples have occurred in France, and two took place in Austria and Hungary. A violent explosion was heard at L'Aigle, in Normandy, and at a distance of eighty miles round L'Aigle at one o'clock in the afternoon of the 26th of April, 1803, a few minutes before the explosion was heard, a luminous meteor with a very rapid motion appeared in the air, and the explosion heard at L'Aigle was caused by the bursting of the meteor. Two thousand stones fell at L'Aigle, upon trees, pavements, and the roofs of houses, so hot as to burn the hands when touched, and one person was wounded by a stone upon the arm. The shower extended over an oval area nine miles long and six miles wide, close to one extremity of which the largest of the stones was found; but the only description I have seen at all approaching graphic was, that some thought their chimneys were on fire, and rushed out for a pail of water. A very similar shower of stones fell at Stannem, between Vienna and Prague, on the 22nd of May, 1812, when 200 stones fell upon an oval area eight miles long by four miles wide. The largest stones, in this case, were found, as before, near the northern extremity of the ellipse. The third stone-fall occurred at Orgueil, in the south of France, on the evening of the 14th of May, 1864. The area in which the stones were scattered was eighteen miles long by five miles wide, and the largest stone was picked up at the eastern extremity of the area. Lastly, at Kuyahinza, in Hungary, on the 9th of June last year, an aërolite, weighing six hundred-weights, was deposited, with nearly one thousand lesser stones, on an area measuring ten miles in length by four miles wide. The large mass was found, as in the other cases, at one extremity of the oval area, and a luminous meteor, followed

by a loud explosion, accompanied the stone-fall, which left a smoky streak, visible in the sky for nearly half-an-hour. A considerable aërolite fell upon the same date in Algiers, at Tadjera, in the present year, and two days later, on the 11th of June, a fire-ball, leaving a streak, visible at least one hour, was seen in full daylight, at sunset, in the north of France, in Switzerland, and in Belgium; and those who were in Paris at the Exposition had doubtless seen many accounts of in the popular papers at that time. Although it was accompanied by a detonation, it discharged no stones, but the coincidence of two stone-falls happening in two successive years on the 9th of June makes it probable that this large fire-ball belonged to the same aërolite date. The largest meteors are obviously divided into two classes, one of which, the bolides, or silent fire-balls, appear to have a looser texture, or to consist of more easily inflammable substance than the rest. They burn very brightly, but without producing an audible concussion of the air. Several true bolides accompanied the last November star-shower. Aërolitic fire-balls, as their name implies, frequently precipitate solid stones upon the ground. Fire-balls of this class are accompanied by a detonation. Four such fire-balls have happened within the last few years, on or about the 20th of November. The list of fire-balls observed hitherto numbers some thousands, and as far as their appearance in comparison with certain shooting-stars is concerned, the latter present a dwarfed resemblance to the former, so that it is probable that no break exists, but that fire-balls of every kind are shooting-stars of a larger stature.

(To be continued.)

VOLATILITY OF THE COMPOUND OF IRON WITH SULPHOCYANOGEN.

By WILLIAM SKEY.

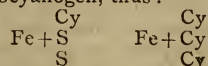
Analyst to the Geological Survey, New Zealand.

WHEN a solution of sesquichloride of iron and an alkaline sulphocyanide is treated with a large excess of hydrochloric acid, there is evolved, even at common temperatures, a notable quantity of a red coloured compound which is best arrested and collected by porous bodies or rough surfaces. It gives the reactions of iron and sulphocyanogen.

The production of this volatile iron compound is easiest observed by placing a solution of the above substances in a shallow vessel resting upon white paper, over which a slightly larger vessel is inverted; in a short time a red coloured ring appears upon the paper. The penetrability of this vapour is such that in a short time it traversed through five thicknesses of thick writing paper.

As thus attached to paper, it did not re-volatilize or change in a neutral atmosphere at a temperature of 200°F.; but on moistening the paper with water, its colour immediately went. In ether, however, it is soluble without change of colour.

The composition of this volatile iron compound I hope to be able to furnish by the next homeward mail. In the meantime I cannot avoid remarking how its volatility at low temperature, its colorific properties, and its production only in presence of a more powerful acid than the hydro-sulphocyanic, gives force to the supposition that the iron present in it is united with the element of sulphocyanogen to form a salt radical of the same molecular constitution, probably, as ferrocyanogen, thus:



the sulphur occupying the place of as many equivalents as cyanogen, at all events with the exception of the compound of sulphocyanogen with tungsten. I should be inclined to view it as differently constituted to the sulphocyanides just described.

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEETING, AT DUNDEE.

President—PROFESSOR BENTLEY, F.L.S., M.R.C.S., &c.

(Continued from page 167.)

"On Burgundy Pitch."

By DANIEL HANBURY, F.R.S.

The authors of the British Pharmacopœia have defined Burgundy Pitch (*Pix Burgundica*) as a resinous exudation from the stem of the Spruce Fir, *Abies excelsa* DC. (*Pinus Abies* L., *P. excelsa* Lam.) melted and strained. They have thus followed the London College of Physicians, which for nearly a century and a half has included this substance in its *Materia Medica*, indicating in the later editions of its Pharmacopœia a similar botanical origin.

On the Continent the term *Pix Burgundica* (which is not frequently applied) appears to have a less definite signification than with us, being used synonymously with *Resina alba* to designate the resins of various coniferous trees after purification by being boiled in water and strained.

In France as in England the term *Burgundy Pitch* (*Pois de Bourgogne*) is by the more accurate writers restricted to the melted and strained resin of the Spruce Fir, of which substance the following description is given in the last edition of the Codex:

[Translation] Burgundy Pitch is of brownish yellow, solid and brittle in the cold, flowing when warm, very tenacious, having a peculiar odour, and an aromatic taste without bitterness; not completely soluble in alcohol in the cold. There is frequently substituted for it another product called white pitch [*poix blanche*], prepared with *galipot** or a mixture of yellow resin and Bordeaux turpentine, melted and mixed with water; this artificial pitch has a strong smell of Bordeaux turpentine, and a very marked bitter taste. It is entirely soluble in alcohol.

Where then is true Burgundy Pitch manufactured? Is it actually met with in commerce? By what characters may we judge of its purity?

The authors of the British Pharmacopœia mention it as a production of Switzerland, where the Spruce Fir is certainly found in great abundance. But I have it upon excellent authority, that of my friend Dr. Flückiger of Bern, that at the present time no terebinthinous resins are collected in Switzerland for commercial purposes. Neither is true Burgundy Pitch produced in France, as its name would seem to indicate, *Pinus maritima*, Lamb., being in fact the only tree the resin of which is collected in that country as an industrial product.

I examined the various collections of forest-products in the French Exhibition. From Finland I discovered a suite of specimens illustrating this very subject. Baron Linder of Svarta, near Helsingfors, is the exhibitor of the resin of the Spruce Fir in two forms, namely:

1. The crude resin as exuded from the trunk of the tree and described in the following words: "*Barras ou gomme concrète, adhérente aux sapins (Pinus Abies). Produit brut servant à la fabrication de résine, etc., etc.*"—Prix 12 francs les 100 kilogr.

2. The resin purified by melting in contact with the vapour of water, and straining. It is thus described on the label attached to the specimen: *Résine jaune cuite (à vapeur d'eau à chaleur modérée) de barras de sapin (Pinus Abies).* Prix 40 francs les 100 kilogr.: production annuelle 35,000 kilogr.

* (Note by translator) *Galipot*, dry resin collected in France from the trunks of *Pinus maritima*, Lamb.

Of these two resins, the first is not found in English commerce: the second constitutes genuine Burgundy Pitch, precisely such as may be bought in the London market. The quantity of this purified resin produced annually, it will be observed is very considerable, being equivalent to 77,000 pounds, or more than 34 tons weight. The Paris exhibition shows that true Burgundy Pitch is also produced in Germany.

Another exhibitor of genuine Burgundy Pitch is Mr. Theodor Müllner, of Hinter Brühl Post Mödling, near Vienna, who shows *Fichtenharz* or crude resin of the Spruce Fir and *Fichtenpech*, which is the same in a purified condition. The latter may be regarded as a type of good Burgundy Pitch.

These contributions to the Paris Exhibition show that the resin of the Spruce is collected for trade purposes in Finland and in Germany,—and in the first named country upon a very considerable scale. It does not, however, appear that it is ever termed *Burgundy Pitch* in the places where it is produced.

Although genuine Burgundy Pitch (usually, it must be admitted, in a very impure state) has been always obtainable in the London market, it is rarely found genuine in the shops,—an artificial compound being very generally supplied in place of it.

In examining the characters of genuine and spurious Burgundy Pitch, I have noted the following differences:

True Burgundy Pitch.

Colour dull yellowish brown; fracture shining conchoidal; translucent; some samples contain much water, and are opaque and of a dull grey colour, and require straining to free them from impurities. Odour peculiarly aromatic.

Not wholly soluble in alcohol of 838, but leaves a small amount of fine white flocculent matter.

Placed in contact with double its weight of glacial acetic acid in a vial, is dissolved with the exception a small amount of flocculent matter.

The foregoing characters apply to most of the artificial Burgundy Pitch which I have examined, and may be useful, so far as they go, for distinguishing the genuine from the spurious. The odour of true Burgundy Pitch is in itself an excellent criterion which cannot be conveyed by description. Solubility in glacial acetic acid serves to reveal the presence of fatty matter which is a common, perhaps an essential ingredient in the artificial Burgundy Pitch made in this country.

From what has preceded may be deduced the following

Conclusions.

1. True Burgundy Pitch is the melted and strained resin of *Abies excelsa*, DC.
2. An artificial compound is usually sold in lieu of it, both in this country and on the Continent.
3. True Burgundy Pitch is produced on a large scale in Finland, also of very fine quality in Baden and in Austria.
4. True Burgundy Pitch differs palpably from the artificial, and may be easily distinguished from it.

Solder for Steel.—The best solder for fine steel work, according to the *American Artisan*, is composed of nineteen parts of silver, one part copper and one part brass. Borax is the best flux.

ON FLUO-SILICATE OF BARIUM.

By M. Fr. STOLBA.

To obtain this salt free from sulphate of baryta and silica, first add to the hydro-fluosilicic acid a little baryta, and separate the precipitate obtained; the filtered acid then contains neither sulphuric acid nor silica, and gives a pure salt by saturation with hydrate of baryta.

The pure fluo-silicate of barium is in the form of small microscopic prisms, when obtained by boiling with diluted liquids; these prisms are united in clusters or disposed in stars.

Its density at $21^{\circ} = 4.2772$ (mean). It dissolves at 21° in from 3262 to 3319 parts of water, and in 3731 parts of water at 17° ; boiling water dissolves about three times as much.

Acids dissolve it more easily, and some salts also increase its solubility. It dissolves at 22° in 272 parts of nitric acid (containing 8 per cent of N_2O_5), and in 448 parts of hydrochloric acid containing 4.25 per cent of HCl.

To dissolve it requires 563 parts of a concentrated and boiling solution of sea-salt; 349 parts of a boiling solution of sea-salt, containing 10 per cent of this salt; 2185 parts of a solution at 10 per cent of sea-salt at 20° ; 1140 parts of a solution at 5 per cent at 20° ; 306 parts of a solution of saturated sal-ammoniac at 22° ; 361 parts of a solution of sal-ammoniac at 15 per cent at 22° .

Dilute sulphuric acid slowly decomposes the fluo-silicate of barium when cold, rapidly with heat. This property may be utilised in the preparation of pure hydro-fluosilicic acid; to do this, digest with heat the fluo-silicate of barium, well divided, with nine-tenths of the sulphuric acid necessary wholly to decompose it, until the filtered liquid contains no traces of sulphuric acid.

Sulphates also rapidly decompose the fluo-silicate of barium, but incompletely. Boiled with the alkaline carbonates, it decomposes, leaving a mixture of silica and carbonate of barium; but some silica which adheres strongly to the sides of the vessel is produced at the same time. Calcined with sal-ammoniac, a large portion is changed to chloride of barium, but a complete transformation is very difficult.

The aqueous solution of fluoride of barium is one of the best tests to ascertain the presence of sulphuric acid in the solution of hydro-fluosilicic acid, or of fluosilicates, it is preferable to sulphate of strontium.—*Journal für Praktische Chemie*, xcvi. 22.

REPORTS OF SOCIETIES.

ACADEMY OF SCIENCES.

SEPT. 30, 1867.

(FROM OUR OWN CORRESPONDENT.)

The Pascal-Newton Forgeries—Sulphuric Acid in Living Mollusca—Transformation of Wood Spirit into Aldehyd—Experiments on Projectiles.

THE secretary, M. Coste, read a letter, on the Pascal documents, from Mr. Robert Grant, Regius Professor of Astronomy at the University of Glasgow, transmitted by M. Le Verrier, and inserted also in the *Times*. The learned author of the history of physical astronomy demonstrated invincibly—and we agree with him—that the numbers expressing the masses of the sun, the earth, Jupiter

and Saturn, the densities of these bodies, and the force of gravity at their surface, that are found in Pascal's notes, were copied from the third edition of the *Principia* given by Newton in 1726; and from this simple fact Mr. Grant concludes that *all the mass of documents communicated by M. Chasles to the Academy of Sciences are forgeries*. Evidently this conclusion is not contained in the premises, and Mr. Grant errs against the rules of logic. He ought to have confined himself to his first alternative: either Pascal had received from an unknown observer the elements of calculation identical with those of Newton; or, the numbers of his note had been simply copied from the third edition of the *Principia*; and this note is not in Pascal's handwriting.

M. Chasles confessed that it is difficult to explain the coincidence pointed out by Mr. Grant; but his letter does not invalidate the capital fact of the relations between Pascal and Newton, corroborated by irresistible proofs. Here is a very striking one. In one of his letters to Huyghens, Pascal defined the quantity of movement, and gave as its value the product of the mass by the square of the velocity, and deduced from this expression different practical conclusions. Huyghens, in his answer, expressed to Pascal the fear of an error on his part. The quantity of movement, he said, was proportional, not to the product of the mass by the square of the velocity, but to the product of the mass by the velocity. The two letters of Pascal and Huyghens are in the hands of M. Chasles; also, a letter in which Newton communicates to Huyghens this same definition of the quantity of motion, and the answer of Huyghens affirming that he formerly pointed out to the late M. Pascal the error into which he had fallen. The close approach of these four letters, which cannot have been forged, leave not the least doubt as to the communications made by Pascal to Newton. The same relations between these two great geniuses is still more evident from the very curious and extraordinary series of letters, or projects of letters exchanged between Newton, James II., and Louis XIV. We again repeat that the mass of proofs in the possession of M. Chasles is so overwhelming that we are forced to yield before the evidence.

M. Coste read also a letter in which Sir David Brewster, to whom M. Chasles had sent four of MS. notes of Newton, gave an account of the comparisons made by the Earl of Portsmouth, the Earl of Macclesfield, and Sir Frederick Madden, between these notes and authenticated letters and signatures of Sir Isaac Newton. The conclusion of this examination shows that not only were the letters forgeries, but that the forger could never have seen the writing or signature of Newton otherwise than in the general Dictionary, or in the Macclesfield correspondence published in 1841. M. de Khanikof, as ocular witness of one of these comparisons, had reported to M. Chasles that the cause of this judgment was principally owing to the permanent difference between the *c* and the *n* of the notes from those in the authentic documents; now, in searching anew in the immense collection of M. Chasles, he found notes in which the *c* and *n* were the same as those in the English MSS., and others in which the same letters have a different form in the English documents, and in the French notes placed by M. Chasles in the hands of Sir David Brewster; the two forms are also found in a Latin letter of Newton, of which Father Secchi has brought a fac-simile from Geneva. In fine, the handwriting of a man varies with time; the differences between the writing of the same hand corresponding turn by turn in English, French, German, and Latin are sufficient to account for all the differences pointed out by the friends of Sir D. Brewster, and remove any serious objections raised by these comparisons. The fact that Newton had four or five different signatures, faithfully found in the notes of M. Chasles, and the extremity, to which Sir David Brewster is reduced, of pretending that the forgeries are recent and posterior to 1841, when speaking of the documents

from the collection of M. Desmaizeau, are powerful arguments in favour of the authenticity of the autographs of M. Chasles.

M. Dumas communicated a curious note, by which M. de Luca determined in the liquid contained in living mollusca the presence of a thirtieth part, or about 3 per cent of pure sulphuric acid; and stated also, that the same mollusca plunged in water disengages a considerable quantity of carbonic acid.

M. Dumas also laid on the table a work of great interest by Dr. Hofmann, on the transformation of wood-spirit into aldehyd, a problem which MM. Dumas and Peligot had vainly attempted to solve. Dr. Hofmann placed in a sufficiently long tube a spiral of platinum, which he raised to the temperature of incandescence by means of a voltaic current, then he traversed the tube by a continuous jet of the vapour of wood-spirit; this vapour is sufficiently heated to be decomposed, and transformed into aldehyd, which can be collected in the form of a continued stream; the operation can be continued for several days, and it has been proved that more than two-thirds of the wood-spirit is converted into aldehyd.

M. Dumas resumed the very original experiments made by M. Melsens on projectiles. By causing a leaden ball to fall into water from the height of about a mètre, he found that the ball drew along with it twenty times its volume of air. This same ball projected several mètres, by powder, to the interior of a cylinder, filled with water, the two vertical openings of which are shut by diaphragms of plaster, introduced into the cylinder nearly a hundred times its volume of air. If the initial velocity is small, the hole is about the same size as the ball (11 millimètres); by increasing the velocity it is much enlarged in size, and when considerably increased the hole becomes enormous. It is impossible to assign the cause of the increase of the hole to the ball alone. Also, when the velocity of projection is excessive, there is a double border inside and outside formed round the holes where the ball enters and quits.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, OCT. 2, 1867.

Formation of Volcanic Sal-ammoniac.—Power of the light of the electric spark to penetrate space.—Solar radiation at high elevations.

M. ANGIOLO RANIERE has presented a memoir to the Academy of Sciences relative to the martial sal-ammoniac collected on the lava of Vesuvius during the eruption of 1850, starting from the region known by the name of the *Atrio del Cavallo*, as far as the south-east of the actual crater.

For a long time past naturalists have been divided upon the question of the origin of the sal-ammoniac disengaged by the fumes of volcanic lava. (See third series of the "*Annales de Chimie et de Physique*, 1853," pp. 289 & 292). Some admit that the hydrochloric acid, escaping from lava in motion, united to the iron which enters into their composition, formed a perchloride of iron, which, joined to the ammonia of the atmosphere, and to the excess of hydrochloric acid of these same lavas, would give rise to this mixture, of simple ammoniacal salt, and perchloride of iron, collected in the fissures.

This opinion does not agree with facts observed by M. Ranieri during the flow of the lava at the eruption of Vesuvius in 1850. He observed that no fumes existed except where the lava had invaded a cultivated and manured

territory; also that these fumes were in such abundance that they gave more than 10,000 kilogrammes of salt of ammonia,* while, at another spot where the igneous current had taken its direction over the lava of 1834,† which was nothing but a rocky and sandy mass, there were found no salts of ammonia.

This fact demonstrates clearly that the ammoniacal salt proceeds from the decomposition of organic substances contained in the ground invaded by the lava, which effects, at a great heat, a sort of distillation, during which carbonate of ammonia is disengaged, to be converted into sal-ammoniac by the action of hydrochloric acid. We shall speak of the origin of this latter presently.

After the extreme intensity of heat has fused the silicic acid of this lava it acts on the silex of the lands surrounding Vesuvius. These latter are in a great portion formed of quartz, sand, and pouzzolana; and in the same manner as quartz acts in the preparation of phosphorus, by the process of Wöhler, the silex reacts on the sea-salt of these lands, as well as on other chlorides which they contain, and gives rise to muriatic acid, and to chloride of iron, with the hydrate of the sesquioxide of iron contained in the ground. Both of these products being volatile at this very elevated temperature, the result is that they acquire an extraordinary expansive force, and when the lava is yet soft they make their way through the mass, and compose what is called "fumerolles." From this gas emanates an aqueous vapour and a mixture of perchloride of iron, chloride of ammonium, sulphurous acid, sulphuretted hydrogen, &c. This lasts as long as the lava is not quite cold.

Mr. Felix Lucas, concludes from very original thermochemical considerations, that the luminous distance at which the electric spark is visible is greater than that of a permanent light the apparent intensity of which would equal 250,000 times that of the spark. The light actually employed to illuminate our new lighthouses gives a brilliancy equal to 125 carcel lamps. An electric spark possessing the illuminating power of the zooth part only of a carcel burner, is superior as to its power of projecting light. Hence we can conceive the immense effect of a warning light composed of intermittent flashes of the electric spark proceeding from a strong Leyden jar battery. M. Lucas states that, in an experiment made in a laboratory, two apparatuses were established, one voltaic equal to 125 carcel lamps, and another spark-battery equivalent to only the 1-2000th part of a carcel wick. The photometer (such as is employed in the lighthouse administration) showed a marked superiority in favour of the spark.

Actinometric experiments made with the greatest care, at Geneva, on the glacier des Bossons and on the summit of Mont Blanc by M. Sorel, have led him to the following conclusions:—The increase of the radiation in proportion as the altitude is less rapid than the diminution of the barometric pressure, or than the diminution of the atmospheric thickness. This result is contrary to what can be deduced from the observations made by Mr. Forbes, in 1832, on the Faulhorn, and the Brientz, (*Phil. Trans.* 1842, part ii, p. 225). The atmospheric pressure being the same, the radiation observed at an elevated altitude is incontestably more powerful than at a lower altitude.

The ratio of the intensity of the solar radiation on Mont Blanc and Geneva is as about 6 to 5. Thus the solar heat which has arrived as far as 4,800 mètres above the superior strata of the atmosphere, is subject to an absorption of $\frac{1}{3}$, in traversing at an angle of 60° to 65°, the lower strata of the air at an altitude of 400 mètres.

F. MOIGNO.

* Antonio de Napoli, dealer in chemical products at Naples, bought more than a hundred quintals, and he has still twenty quintals left. Many other speculators have followed his example.

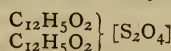
† This lava destroyed a whole well populated district of more than two hundred dwellings in the commune of Ottaviano, at a spot called Tersigno. It furnished also several hundred quintals of salts of ammonia. M. Ranieri is of opinion—and his theory is in perfect harmony with facts—that the muriatic acid proceeds from either rock-salt in the ground or from the infiltration of sea-water.

CHEMICAL NOTICES FROM FOREIGN
SOURCES.

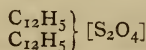
Tyrosin, derivatives of.—G. Beyer. Tyrosin was obtained by boiling one part of horn turnings with two of sulphuric acid and ten of water; the liquid was neutralised with calcic hydrate, filtered, and evaporated to half its original bulk. The calcium-compound of tyrosin was then converted into the corresponding lead-compound; this decomposed by sulphuretted hydrogen and the solution evaporated to crystallisation. It was converted into the nitrate, and then, according to Städeler's method, into nitrotyrosin. This nitro-compound is reduced to amidotyrosin, $\text{C}_9\text{H}_{12}\text{N}_2\text{O}_3$, by the action of tin and chlorhydric acid. The amido-compound is very deliquescent, but may be obtained as a crystalline powder by concentrating its aqueous solution at 100° , and cooling under the dessicator in a vacuum. It is anhydrous, sparingly soluble in hot alcohol, and is not decomposed when heated to 100° . It dissolves readily in diluted acids, forming well defined salts. Of these the hydrochlorate $\text{C}_9\text{H}_{12}\text{N}_2\text{O}_3 \cdot 2\text{HCl} + \text{H}_2\text{O}$ —two sulphates $\text{C}_9\text{H}_{12}\text{N}_2\text{O}_3 \cdot 2\text{H}_2\text{SO}_4$, and $\text{C}_9\text{H}_{12}\text{N}_2\text{O}_3 \cdot \text{H}_2\text{SO}_4$ —and a double sulphate of amidotyrosin and zinc, $\text{Zn}_2\text{SO}_4 + 2(\text{C}_9\text{H}_{12}\text{N}_2\text{O}_3 \cdot \text{H}_2\text{SO}_4)$ are described.—(*Arch. Pharm.* [2] 130 44.)

Lecture Experiment.—A. Baeyer. When a glass rod, moistened with chlorhydric acid, is plunged into a flask, containing a few drops of an alcoholic solution of propargylic ethide $\text{C}_2\text{H}_3 \cdot \text{O} \cdot \text{C}_2\text{H}_5$, thick, white clouds, like sal-ammoniac, are formed. This phenomenon evidently consists of an addition of ClH to the ether; by which the compound $\text{C}_3\text{H}_4\text{Cl} \cdot \text{O} \cdot \text{C}_2\text{H}_5$ is formed, and may serve as an illustration of the similarity which exists between non-saturated carbon-compounds and ammonia.—(*Ann. Chem. Pharm.* cxlii. 326.)

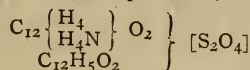
Oxysulphobenzid.—L. Glutz. It is still a matter of uncertainty whether phenol is to be considered as the hydrate of phenylic oxide $\text{C}_{12}\text{H}_5\text{O} \cdot \text{HO}$, or as oxybenzol $\text{C}_{12}\text{H}_5\text{O}_2 \cdot \text{H}$. Supposing the latter to be the correct view, the action of sulphuric acid upon phenol will give rise to the formation of an oxysulphobenzid



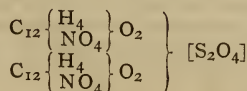
corresponding to the sulphobenzid



from benzol. This reaction does indeed take place when two parts of phenol and three of sulphuric acid are heated together to 160° — 170° . Oxysulphobenzid is sparingly soluble in cold water, readily in hot water, alcohol and ether. It has the properties of a weak acid; when dissolved in ammoniac hydrate, and left to evaporate at ordinary temperatures, the compound

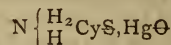


crystallises out. Nitric acid converts it into nitro-oxysulphobenzid



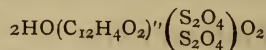
which is insoluble in cold, sparingly soluble in hot water, soluble in alcohol. Strong sulphuric acid dissolves oxysulphobenzid at the ordinary temperature without decomposing it; when heated, decomposition takes place, in course of which oxyphenylsulphuric acid is formed.—(*Zeitschr. Chem.*, N. F. iii. 435.)

Mercuric Sulphocyanides.—T. Philipp. The white precipitate which is formed by adding potassic sulphocyanide to mercuric nitrate, and which is soluble in an excess of either salt, is mercuric sulphocyanide, HgCy_2S . Potasso-mercuric sulphocyanide, $\text{HgCy}_2\text{S}_2 + \text{KCyS}$, is formed when mercuric nitrate is added to potassic sulphocyanide until the originally white precipitate is converted into a yellowish crystalline mass. The double-salt of mercuric cyanide and potassic sulphocyanide, $\text{HgCy}_2 + \text{KCyS} + 2\text{aq.}$ is obtained by mixing solutions of its two constituents together. Compounds of mercuric iodide, bromide, and chloride with potassic sulphocyanide may be obtained in a similar manner. The basic mercuric sulphocyanide of Claus, which is formed by adding ammonia to potasso-mercuric sulphocyanide, has the composition,



(*Pogg. Ann.* cxxxi. 86.)

Oxyphenylendisulphonic Acid.—C. Weinhold. This acid is obtained, besides phenol sulphuric acid, from phenol by the action of sulphuric acid. The author prepares it in the following manner: sulphuric anhydride is distilled into a well cooled flask containing crystallised phenol; the reaction which thus takes place with moderate energy is completed by exposing the contents of the flask to the temperature of the water-bath for a couple of hours. The mixture is then diluted with water, and the new acid separated from the excess of sulphuric acid by fractional precipitation with plumbic carbonate. The solution of the neutral lead-salt is readily decomposed into a soluble acid and difficultly soluble basic salt; and by adding further quantities of plumbic carbonate, the whole may be converted into the basic salt, and thus be freed from phenol sulphuric acid which remains in solution. The oxyphenylendisulphonic acid is now isolated by means of sulphuric acid and sulphuretted hydrogen. It is a dibasic acid; its composition is:



It is readily soluble in water and alcohol, and with difficulty obtained in crystals. Its salts, with the exception of the basic lead salt, are also very soluble in water and alcohol.—(*Ann. Chem. Pharm.* cxliii. 58.)

CORRESPONDENCE.

THE SODA TRADE.

To the Editor of the Chemical News.

SIR,—I beg here to offer some remarks on Mr. Wright's paper in your last impression. He complains of the trade use which retains the old equivalent (24) for sodium, and it can certainly not be denied that it would be far better if the right equivalent (23) were taken instead. But I must protest against Mr. Wright's calling this well-known practice "a barefaced fraud." The facts of the case are known to most or all important buyers of soda-ash, and all bargains are made on the express condition of going by the analysis of some analytical chemist who may or may not take 24 as equivalent for Na, but will take 24 in most cases. The choice of the analytical chemist is practically always in the hands of the buyer. Does Mr. Wright really mean to impute a "barefaced fraud" to the great majority, if not to the whole, of the chemical manufac-

turers in this country? Besides, would they on their side submit to the equivalent 44 for peroxide of manganese if they considered it a "barefaced fraud," and not a custom of the trade which is understood by buyer and seller?

Mr. Wright further supposes that for the estimation of chlorine of lime the iron process is the one generally used, and he asserts that all its known sources of inaccuracy tend to heighten the apparent percentage of chlorine. But he overlooks two important sources of possible errors, viz., the efflorescence of the ferrous salt and the escape of chlorine during the operation, the latter of which can hardly be totally avoided, and both of which lower the apparent percentage. It is, consequently, generally assumed that the iron process shows a little lower percentage (say 1 per cent) of available chlorine than the arsenite of soda process, and the latter, far more reliable one, is rightly superseding the former more and more in the laboratories.—I am, &c.,
A PRACTICAL CHEMIST.

MISCELLANEOUS.

The Newton-Pascal Forgeries.—Dr. T. Archer Hirst, F.R.S., writes to *The Times* as follows:—

Sir,—In a communication to the British Association at Dundee, I stated that M. Chasles, desirous of submitting his newly acquired papers to every possible test, had forwarded specimens of the alleged handwriting of Newton to Sir David Brewster and myself through his friend M. de Khanikof. Sir David Brewster has since submitted five of these specimens to the inspection of the Earl of Portsmouth, the Earl of Macclesfield, and Sir Frederic Madden, and the unanimous verdict of these authorities, as recorded in the *Athenæum* of September 28, is "that the handwriting is not that of Newton."

On Thursday last, M. de Khanikof accompanied me to Burlington House for the purpose of further comparing these specimens with the authentic letters of Newton in the possession of the Royal Society. We were assisted in our investigations by Dr. Sharpey, and the result was perfectly conclusive,—in short, entirely in accordance with the verdict above quoted. We also searched for evidence of a more positive nature touching the origin of these documents, and were rewarded with success. Without troubling you with the details of this new investigation, I may state that our efforts were first directed towards obtaining further information relative to the Pierre Desmaizeaux whose name so frequently appears in M. Chasles' documents. We found that at the commencement of the 18th century this gentleman resided in London; that on the 3rd of November, 1720, he was admitted a Fellow of the Royal Society by Sir Isaac Newton, then president; and that shortly before his election he had presented to the Society a copy of his new work, entitled, *Recueil de diverses Pièces sur la Philosophie, la Religion, &c., par MM. Leibnitz, Clarke, Newton, &c.* (Amsterdam, 1720.) On turning over the pages of the second volume of this work Mr. Walter White (assistant secretary to the Royal Society) had the good fortune to discover that three out of the five of the alleged specimens of Newton's handwriting were *verbatim* copies of isolated passages occurring in the French translation of three letters originally written by Newton in English. To each passage thus extracted the forger had appended Newton's name as a signature.

Without further comment on this annihilating fact, I pass to a more astounding one. Here is an exact copy of a fourth document alleged to have been written by Newton:—

"La réalité de l'espace n'est pas une simple supposition; elle a été prouvée par les arguments que j'ay rapportez, auxquels on n'a point répondu. On n'a point répondu non plus à un autre argument; savoir, que, l'es-

pace et le temps sont des quantitez, ce qu'on ne peut dire de la situation et de l'ordre.

"I NEWTON."

Newton is here made to copy and sign a garbled translation of a passage to the authorship of which even he has not the slightest claim; The real author is the well-known Dr. Samuel Clarke, rector of St. James, Westminster, between whom and Leibnitz a celebrated discussion on the principles of natural philosophy and religion was conducted by letters in 1715-17. In 1717 Dr. Clarke, after having had Leibnitz's letters carefully translated from French into English, and his own from English into French, published the whole correspondence in duplicate. From a copy of this work now in the British Museum I extract the following paragraph in Dr. Clarke's fourth reply to Leibnitz:—

Page 134.

"Sec. 14. La réalité de l'espace n'est pas une simple supposition; elle a été prouvée par les arguments rapportez ci-dessus, auxquels on n'a point répondu. L'Auteur n'a pas répondu non plus à un autre argument, savoir, que l'espace et le temps sont des quantitez; ce qu'on ne peut dire de la situation et de l'ordre."

Page 135.

"Sec. 14. The reality of space is not a supposition, but is proved by the foregoing arguments, to which no answer has been given. Nor is any answer given to that other argument, that space and time are quantities, which situation and order are not."

It will be observed that in copying the passage on the left—not from Dr. Clarke's work, but from Desmaizeaux's *Recueil*, where the French addition *only* of the correspondence was re-published,—the forger has, in one or two places, slightly departed from the original text. His motive for so doing has obviously been to render the extract somewhat less unsuited to the illustrious name he had the audacity to append thereto.

M. Chasles, whose disinterested integrity as a historian is beyond question, has hitherto declined to admit the possibility of the fabrication of the numerous documents in his possession. "Un faussaire," he has urged, "qui aurait fabriqué toutes ces lettres, toutes ces pièces, pour prouver qu'il a existé des relations entre Pascal et Newton, aurait eu bien du talent, puisqu'il aurait fait tout à la fois du Pascal, du Newton, du Montesquieu, du Leibnitz," &c. We know, at all events, in what manner this *faussaire a fait du Newton* without the expenditure of any talent whatever; and, knowing this, we cannot but regard the entire collection of documents as wholly untrustworthy—as wholly unworthy, indeed, of the further patronage of the eminent author of the *Aperçu Historique*.

Technical Education.—The following is a brief outline of the provision made by law in the Netherlands, in order to secure proper technical education for all classes of society. Section 12 of the law, which came into operation on the 1st of July, 1863, sanctions and orders the establishment of the following four descriptions of schools, viz. *a*, schools destined for the education of the ordinary artisans, and labourers, and agricultural labourers; *b*, in a higher class of schools; these are divided into such with three years and five years' course of instruction; *c*, agricultural colleges; *d*, a polytechnic school. Now Holland has always been a country where public instruction has ranked very high, as it does yet. The general government has established fifteen of the schools alluded to *sub. b.*, five of which are with a five years' course of instruction. Moreover, the municipal authorities of all larger towns have established schools as specified *sub. b*. Besides these schools there are in Holland three *Athenæa* established at Amsterdam, Deventer, and Maastricht, these being schools whereat in addition to physical science, also law, medicine, and literature are taught; no degrees however are granted at the *Athenæa*; besides these there are three universities, while there are distinct schools for educating officers of the army and

navy. The whole number of inhabitants of the Kingdom of the Netherlands in Europe is a little over three millions, and the occupation is chiefly agricultural and mercantile, rather than industrial. The law of 1863 on middle class and technical education was made after the lower class education had been thoroughly revised. There are several private middle class schools which have modified their programme in accordance with the law alluded to.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Le Génie Industriel. June, 1867.

F. L. ROUX, "A Method of Preserving Armour Plated and other Iron Vessels by means of Copper Sheathing." BRISSENEAU, "New Apparatus for the Manufacture of Sugar." E. GRISDALE, "A new Apparatus for Washing Photographic Proofs."

Comptes Rendus. July 8, 1867.

BECQUEREL, "Third Memoir on some newly-discovered Chemical Effects of Capillary Action." DAUBREE, "On the Classification adopted by the Paris Museum for the Collection of Meteorites." SECCHI, "On the Nebula of Orion." N. ZININ, "On Benzoïn and its Derivatives." REBOUL and TRUCHOT, "Researches on the Isomerism of the Acetylene Series." T. HIORTDAHL, "On Protosulphide of Cobalt."

July 15.

CHASLES, "Note on the Discovery of the Laws of Attraction by Pascal." SOREL, "Note on a new Cement made by sliking Magnesia with a solution of Chloride of Magnesium." J. NICKLES, "On Fluomanganous Acid and other new Manganese Compounds." LECOQ DE BOISBAUDRAN, "Experiments on Supersaturation." BALBIANI, "On a simple Method of Detecting the Presence of Corpuseles on Silk Worms."

July 22.

DUHAMEL, "Note on Pascal's Correspondence relating to the Laws of Attraction." FAYE, "Note on Pascal's Correspondence relating to the Laws of Attraction." CHEVREUL, "Note on Pascal's Correspondence relation to the Laws of Attraction." CHASLES, "Note on Pascal's Correspondence relating to the Laws of Attraction." CHEVREUL, "Report of the Author's Lectures on Chemistry delivered at the Museum of Natural History." DAUBREE, "Contributions to the Knowledge of the Structure of Meteorites." C. MATTEUCCI, "On the Secondary Electro-motive power of the Nerves, and its Application to Physiology." ZALIWSKY-MIKORSKI, "Note on a New Syphon." G. GRIMAUD DE CAUX, "A Comparative Study of the Results of the Removal of the Sewage Waters of Paris, Vienna, London, Marseilles, and Venice." J. RAYNAUD, "On a Practical Method of Determining the Voltaic Constants of a Battery." G. LECHARTIER, "On the Reproduction of Mimetic and of some Chloro-arsenates." BIZIO, "Some new Researches on Glycogen." PHIPSON, "Note on a Simple Method of Detecting Iodine in the Presence of Bromine."

July 29.

CHASLES, "Some further Communications relative to Pascal's Letters on the Laws of Attraction." DUHAMEL, "Some further Communications relative to Pascal's Letters on the Laws of Attraction." C. MATTEUCCI, "On the Secondary Electromotive Force of the Nerves, and its Application to Physiology." H. SCOUTETTEN, "On some Surgical Instruments found at Herculaneum and Pompeii." FAUGERE, "On the Pascal Correspondence." BENARD, "On the Pascal Correspondence." P. BLASERNA, "On the Duration of Induction Currents." R. D. SILVA, "On Titaniferous Iron Sand from Santiago, Cape de Verd Islands." E. GRIMAUD, "On the Nitro derivatives of the Benzylic Ethers." V. DE LUYNES and A. LIONET, "On the Methylic, Ethylic, and Amylic Derivatives of Orcin." CHEVREUL, "Remarks on J. Lemaire's Experiments on the Properties of Phenic Acid."

NOTES AND QUERIES.

Scarlet Ink.—Can any reader of the CHEMICAL NEWS put me in the way to make a scarlet ink, to write scarlet on blue paper with a steel pen?—B. W.

Detection of Sulphur in Petroleum.—Is there an easy test for the presence of sulphur in refined petroleum? I find a difficulty in knowing when it is sufficiently refined, as I have no ready test for this objectionable impurity.—REFINER.

Preserving Fresh Flowers.—I shall be greatly obliged if any of your courteous readers will kindly tell me how I can preserve cut flowers in a room. I remember reading somewhere that, adding some chemical substance to the water, would cause them to keep fresh for a week or more, but I have forgotten the name of the chemical.—EMILY D.

Clarifying Oxymels.—Can any of your readers inform me of the plan generally adopted by pharmacutists for clarifying oxymels?—SCILLA MARITIMAS.

Succinic Acid.—Is the following reaction of succinic acid known? It has puzzled me considerably, and, before I found out the cause, led me into some mistakes. I have been in the habit of using succinic acid as a means of separating iron from solutions in quantitative analysis. A few weeks ago I was surprised to find that no precipitate was produced under circumstances in which I fully expected to see one, as I knew there was a ferric salt in solution. The solution was almost neutral, and I had added succinate of potash, but no precipitate of succinate of iron took place. After many experiments to ascertain the cause, I ascertained that the non-precipitation was owing to the presence of acetate of potash, which I had added in rather large quantity to get rid of free mineral acid. Following this up, I have ascertained that the presence of acetic acid, or a soluble acetate, partially or entirely suspends the ordinary reaction of succinic acid in solutions of ferric salts. Perhaps a note of this may prove useful to some of your readers, if inserted in your valuable "Notes and Queries" column.—J. HOOPER.

German Yeast.—In reply to F. Ireland, a valued correspondent sends us the following information. The bulk of what is erroneously called in this country German yeast is made at Schiedam, Delfts-haven, and Rotterdam. In a large cylindrical wooden vat, 15 meters high, and 16 meters diameter, a large quantity of tepid water is poured, and 180 kilogrammes of coarsely-ground rye and barley malt are added; this mixture is beaten into a thin paste, and the vat closed with a well-fitting lid; in order to prevent too rapid cooling, it is covered with a stout blanket, and left at rest for about two hours. At the end of this time the paste is diluted with very cold water, and thin distillers wash till perfectly fluid. Beer-yeast of good quality is now added in the proportion of half a kilogramme for every 2,000 litres of fluid; the whole is well stirred and left to settle. Fermentation soon commences, and after from five to seven hours the larger portion of the fluid is carefully drawn off from the sediment and collected in a tank; thence it is pumped into shallow wooden troughs placed under shelter and surrounded on all sides by louver blinds. Each trough is 4 meters long, 275 broad, and 0.5 deep. The liquid shortly becomes very turbid, a thick mass, not unlike boiled starch, settles to the bottom, and the surface also becomes covered with a thick coherent cream-like scum; each of these deposits is the yeast; after 24 hours the intermediate fluid is withdrawn and returned to the original vat, whence it had been taken. The yeast is collected in bags made of strongly-woven linen canvass, and submitted to great pressure for 24 hours; it is then fit for use, and is exported as dry yeast. When one-third by weight of best barley malt and two-thirds of rye of good quality are used, and the operations carefully conducted, and when it is *not* intended to obtain spirits, the quantity of yeast may be very much increased. There is no truth in the assertion that such materials as chalk, bone-ash, plaster of Paris, French chalk, pipe-clay, &c., are used as adulterants. A small quantity of the best starch is, in the summer, sometimes mixed with the yeast. It makes it keep better in hot weather.

TO CORRESPONDENTS.

J. E. Wright.—For the purpose you name we recommend "Bloxam's Chemistry" published by Churchill. The price is not so high as you say you are willing to go to, but we presume that will be no objection.

A Subscriber from the commencement of the CHEMICAL NEWS.—The sign ∞ in mathematical language is the sign of infinity. Consult the article "Crystallography" in Watt's Dictionary.

W. E. Bickerdike.—Received with thanks. We believe a native hydrated ferric oxide is now used.

F.V.—The note arrived too late for insertion last week. The problem has now been solved. Accept our thanks for the same.

E. M. Delf.—We are sorry we cannot accede to our correspondent's request. The journal is not now in our possession. It can, however, be obtained through a foreign bookseller.

H. W. Tapper.—Will o' the Wisp paper is simply gun-paper, i.e. paper rendered explosive like gun-cotton. The flame may be coloured by soaking it in nitrate of baryta, strontia, &c.

Erratum.—In the report of Mr. Stanford's paper given in our last number, for chloride of iodine, read chloride of sodium.

Books Received.—The Philosophical Magazine for October.—Scientific Review.—"Second Report of the Quekett Microscopical Club."—Fourth Report of the British Association of Gas Managers, with Rules, Regulations and List of Members.—The Shipwrecked Mariner for July.—Science Gossip, for October.—The Calendar of the Pharmaceutical Society of Great Britain for 1867-68.—Popular Science Review, for October.

Communications have been received from Lord Sackville Cecil; F. Rimington; E. M. Delf; Samuel Highley; Robert Hogg; Dr. Sansom (with enclosure); John Newlands; James Brown and Son; H. W. Tapper; Clayton and Co.; Dr. R. Oxland (with enclosure); William Baxter (with enclosure); R. Robertson (with enclosure); W. Bywater (with enclosure); J. Heywood; Samuel Sharpe; J. Blackburn; Dr. G. Lunge (with enclosure); F. Versmann; Maxwell Simpson F.R.S. (with two enclosures); W. Millar; L. Stokes (with enclosure); D. Forbes F.R.S. (with enclosure). E. C. C. Stanford; H. Dixon.

THE CHEMICAL NEWS.

VOL. XVI., No. 410.

ON THE PROPERTY OF TUNGSTIC AND SILICIC ACIDS TO COMBINE WITH PHOSPHORIC ACID,

AND THE PRESENCE OF THIS ACID IN OPAL, FLINT,
QUARTZ, &c.

By WILLIAM SKEY,

Analyst to the Geological Survey of New Zealand.

IN considering the behaviour of molybdic with phosphoric acid, it occurred to me whether other analogous phospho-compounds with the more insoluble mineral acids might not be made, or even have a present existence, but unrevealed, owing to the want of those decided colorific and physical changes which are involved in the production of phospho-molybdic acid from its individual compounds, and which in all probability led to the discovery of their mutual chemical affinities for each other. Many reasons for the possible existence of such compound presenting themselves, I began a course of experiments with tungstic acid, when it was soon ascertained most conclusively that this acid was able to effect a combination with phosphoric acid, in acid solutions. The compound so formed is void of colour even when boiled, whereas recently precipitated tungstic acid soon contracts a persistent yellow colour; under similar circumstances, the colour proper to the ignited acid.

Following up the subject, silica was next selected for examination, and the results thereof appearing to have some degree of interest, I would beg to state them here.

In the first place, a portion of quartz rock was pounded and fused with a mixture of carbonate and phosphate of soda, and subsequently treated in exactly the same manner as that described by Fresenius for the separation of silica. The insoluble residue from the hydrochloric acid was then thrown on a filter and washed until not a trace of phosphoric acid could be detected in the washings therefrom. A solution of pure ammonia was then passed through the residue on the filter, and to the filtrate ammonio-chloride of magnesium was added, when a copious gelatinous precipitate appeared, which partly dissolved in acetic acid, and the filtered solution gave a considerable amount of a crystalline adhesive precipitate when rendered alkaline by ammonia: the part insoluble in the acid was silicate of magnesia. A portion of the crystalline precipitate above mentioned furnished yellow crystals when placed in contact with a solution of molybdic acid in nitric acid.

The capacity of silica to retain phosphoric acid in presence of water or hydrochloric acid being thus demonstrated, the possibility of the presence of phosphoric acid in certain of the more siliceous minerals naturally suggested itself; and forthwith I proceeded to examine some of these minerals, when I found unmistakable indications of phosphoric acid. I also detected phosphoric acid in a specimen of flint, and in a portion of the quartz rock already treated of, but in quantity not nearly so large as when phosphate of soda was fused with it in the first experiment. I should state that in this instance, to get a fair comparison, the quartz was first fused with carbonate of soda, so that the whole of the phosphoric acid could be eliminated; but in the case of the other silicas, for the removal of their phosphoric acid for detection, I merely passed ammonia through their very finely ground powders. Subsequently, however, I obtained phosphoric acid from quartz by the same means.

As bearing upon the complete separation of phosphoric acid from granites, basalts, &c., I may further state that, as far as I have gone, I have invariably found phosphoric

acid as a constituent of their silicas as separated for estimation. In one case I obtained 16 per cent of phosphate of magnesia admixed with a small proportion of silicate of magnesia; but in the course of the laboratory work I hope to be able soon to furnish the absolute amount of phosphoric acid thus retained in those *silica residues* which come under my notice.

In conclusion, it would seem that the facts here recited tend to show—First—That the present mode of extracting phosphoric acid from siliceous minerals for estimation is radically wrong, or at least very imperfect, much of the phosphoric acid these minerals may contain being determined to their silica when recently precipitated, if not already in combination therewith. Secondly—That in the great majority of the analyses of silicates, &c., the silica therein is given a trifle too high; and, lastly—That phosphoric acid exists in larger quantity, and is even more widely distributed through the mineral kingdom than has hitherto been suspected—circumstances possessing some degree of interest in connection with both mineralogy and agriculture.

NOTICE OF

NATROBORO CALCITE IN NEW LOCALITIES, AND OF OTHER BORATES IN HANTS COUNTY, NOVA SCOTIA.

By Professor HOW, Windsor, N.S.

IN this journal, April 19th, 1867, I mentioned incidentally some facts respecting the occurrence of natroborecalcite here, and having lately found this mineral in the same matrix in new localities in this county, and also in its neighbourhood at one of these places, some other borates not before observed here, and (one at least) probably new, I offer a short note on the subject as possibly not uninteresting.

The revival of the trade in gypsum with the United States, which had declined very much during the late war, has caused great activity in the quarries of Nova Scotia, especially in this vicinity, which affords the greatest supply to that market. Not less than 70,000 tons of "plaster" have been cleared from this port during the 18 months ending June 30 of this year, the larger part of which has been shipped from the wharves of Windsor, having been brought from several quarries close at hand, or within some six miles. The rock exported consists principally of gypsum, the rest being anhydrite; both are called in the official returns gypsum, and locally, plaster, hard and soft respectively. An excellent opportunity is thus afforded here of studying the varieties of these rocks and the minerals they contain. In one of the heaps of "stones" brought from a quarry which had not been worked for twenty years until last season, I saw a specimen which I at once recognised as natroborecalcite, and, on examination, I found a considerable number of fine specimens, varying in size from that of a pea to that of a small hen's egg, embedded in gypsum, chiefly in a soft grey or "blue" variety, the colour of which rendered the snowy white borate very obvious. The rock was from near the surface of a quarry called Brookville, situated about three miles south of the original locality (mentioned in the paper in this journal above referred to), where the rocks dip gently to the south: low hills and a broad marsh lie between the two quarries. I afterwards observed the same mineral in gypsum from a quarry about six miles north-east of the original locality, but not in such abundance as at Brookville.

The Brookville quarry affords two other borates, one of which is a hydrated silicated borate of lime, apparently a new species. The observation of combined silica in more than traces in these beds for the first time is interesting. The other borate seems to be quite different from any before observed here, but I have not yet subjected it to analysis.

NOTE ON THE

PREPARATION OF CRYSTALLISED PHENIC ACID.

By W. E. BICKERDIKE, F.C.S.

It is seldom that crystallised phenic acid can be obtained by the common process described for its preparation in the text books; and even when the crude liquid does crystallise, the still fluid portion contains the largest amount of the pure acid.

The following process I find always to give good results:—

The impure liquid separated from tar oils in the usual manner by means of soda solution, is first distilled alone, so as to get rid of most of the water and H_2S . It is then re-distilled in a perfectly dry retort with 1 to 2 per cent of anhydrous cupric sulphate, collecting the distillate in 5 or 6 dry flasks. Most of the distillate will crystallise at $16^\circ C.$, though it is generally necessary to drop in a fragment of the solid.

If much H_2S is present, it should be removed by boiling, or by leaving the liquid in an open vessel, over night, previous to distilling with the sulphur.

Dalta Square, Lancaster, September 25th.

ON ULTRAMARINE.

By Dr. ERNST RÖHRIG.

THE manufacture of artificial ultramarine is one of great interest, and has been the object of careful investigations by many eminent chemists during the last fifty years. But none of these investigations have shown the real cause of the colour of ultramarine, nor have they given a sufficient explanation of the chemical changes which the components undergo in its formation. This explanation would be the more interesting as it would supply some hints with regard to the nature of the colouring matter of many minerals, besides many chemical and metallurgical products.

It seems surprising to the writer that this manufacture has not been introduced into England, as the materials used in it are partially English, and the others could be obtained cheaper here than in Germany and France, where the manufacture is carried on to a great extent; and as furthermore the greatest trade and consumption of ultramarine takes place in England.

These facts will, perhaps, render the following communication acceptable to the readers of the CHEMICAL NEWS:

In former times ultramarine was produced from *lapis lazuli*, and being very rare had double the value of gold. The accidental formation of blue ultramarine-like masses in certain chemical processes (manufacture of soda) induced trials for the production of artificial ultramarine. Such trials by Guimet, in Toulouse, and Gmelin, in Tübingen, were crowned with success, almost simultaneously, though both investigations were carried on independently of each other.

Guimet has always kept his discovery a secret, but Gmelin* published his in 1828, and may, therefore, be considered the founder of the present ultramarine manufacture.

Both investigators have, no doubt, taken as the basis of their experiments the composition of the natural ultramarine from *lapis lazuli*. The composition of that ultramarine, according to Desormes and Clement†, is as follows:—

Silica	35.8
Alumina	34.8
Soda	23.2
Sulphur	3.1
Carbonate of lime	3.1
Some inferior sorts also contain iron.	

* *Annales de Chemie* lxvii. 317.

† *Naturwissenschaft. Abhandlungen. Wurtemberg.ii., 191.*

Gmelin's mode of operation is the following:—

Solution of caustic soda is saturated with hydrated silica, and to this hydrated alumina, containing 90 per cent water, is added in such quantity that 35 parts of dry silica, will correspond to 30 parts of dry alumina. This mixture is evaporated to dryness. It is then mixed with some sulphur, pulverised and thoroughly mixed with an addition of dry carbonate of soda and flowers of sulphur. A quantity of each of the latter two substances is added equal in weight to the above dried mixture. This compound is pressed into a crucible, heated as quickly as possible, and kept at a red-heat for two hours. The resulting green-yellow mass is then heated in contact with air till it becomes blue. After this it is boiled out with water and well washed.

A number of different modes of producing ultramarine were afterwards published by chemical investigators.

Robiquet ‡ recommended a mixture of 2 parts china-clay, 3 sulphur, and 3 carbonate of soda.

Tiremon, § 100 parts alumina or hydrated alumina, 1075 crystallised (or 400 dry) carbonate of soda, 221 sulphur, 3 sulphide of arsenic.

Prückner, || 200 parts sulphide of sodium (prepared by heating sulphate of soda with carbon and some sulphur), 50 clay as pure as possible, and 1 green copperas.

Brunner, ¶ heated a mixture of 70 parts sand, 240 alum (the weight calculated for anhydrous alum), 48 carbon, 144 sulphur, and 240 carbonate of soda, in a closed crucible, at a low red-heat for about 1½ hours. The resulting mass, partly of a greenish hue, and partly of a reddish-yellow hue (and which was reduced to ⅓ths of its original volume) was washed. He obtained a light ash-grey powder, which he mixed with an equal weight of sulphur, and with 1½ times its weight of dry carbonate of soda and heated as before. This caused it to take a blueish-green hue. He then spread flowers of sulphur, until about ⅓ of an inch in depth, upon an iron-plate, and on this a similar quantity of the last product, after having pulverised it. By heating the iron plate, he ignited the sulphur, taking care to keep the temperature as low as possible, avoiding heating the ultramarine to redness. After repeating such heating with sulphur 3—4 times, the ultramarine became of a fine dark blue colour. In this process it is necessary to remove the ultramarine from the plate, and to pulverise it afresh each time.

By roasting this ultramarine with sulphur it increases in weight from 5—10 per cent, and it is possible for it to increase still more if the heating is oftener repeated; however, the colour will not improve any more. If the ultramarine be heated without addition of sulphur, a decrease of weight takes place (probably as then sulphur becomes exchanged for oxygen), the ultramarine, becomes paler and the powder more compact and granular.

According to Gentile's published method ultramarine is produced in manufactures from a mixture of clay with sulphate of soda and carbon; or with carbonate of soda, sulphur, and less carbon; and also with sulphate of soda, carbon, carbonate of soda, and sulphur. By heating these mixtures a green ultramarine would result, which by roasting with sulphur, in contact with air, would become blue.

Ritter** used for the production of ultramarine, a mixture of clay, sulphate of soda, and carbon.

He used china-clay from Cornwall, of the following composition.

‡ *Annali de Pharm.*, x. 91.

§ *Comptes Rendus*, xiv. 761.

|| *Dingl. Polyt. Journ.*, xciv. 388.

¶ *Poggend. Annalen*, lxvii. 541.

** *Ritter über des Ultram.*, Göttingen, 1860.

Silica	47.06
Alumina	36.47
Peroxide of iron	1.10
Potash	3.16
Water	12.05
	99.84.

This mixture was roasted at a strong red-heat (900-950°); the result was raw ultramarine, white in colour, similar to that obtained by Brunner. This he called white ultramarine, as it is the first transformation of the alumina by the action of sulphide of sodium. This white compound, when exposed to atmospheric air at common temperatures, does not change, but if heated for some time at 100°, it slightly increases in weight, and if heated to 400° in free contact with air, it will take a dark yellow colour which changes to green on cooling. If the heating is continued for a longer period the Ultramarine will become blue. All the colours produced in this way are very pale, but they may be made much darker; the change takes place in a shorter time if sulphurous acid or chlorine is made to act at the same time, upon white ultramarine.

The components of the white ultramarine, as furnished by analysis, are the following:—

SiO ₃	39.06
Al ₂ O ₃	31.17
Na	17.75
K	1.33
Fe	0.07
a S	4.78
b S	1.42

a S is that which (according to Elsner and Breunlin) is evolved as sulphuretted hydrogen gas, and b S that sulphur which is retained in the residue.

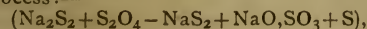
The composition of the white ultramarine may be calculated as follows:—

Si O ₃	39.06
Al ₂ O ₃	31.17
Na O	14.75
K O	1.60
Na S	3.09
Na S ₂	4.88
Fe S	0.11
	99.66

When this white compound is heated it becomes green and then blue, as one atom of S of the NaS₂ burns to sulphurous acid, causing the transformation of the colour.

As before stated, the addition of sulphur hastens the process of conversion. In one of Ritter's experiments, the quantity of extracted sulphur amounted to 1.3 per cent, and exactly the same quantity was contained in the NaO,SO₃ (1.32) formed. From this and from the proportion of SO₃ to the increase of weight it may be calculated that two equivalents, SO₂ combine with one equivalent, Na S forming NaO,SO₃+2S. It is singular that the sulphur of the NaS is not extracted, and that it combines with another portion of NaS of the ultramarine forming a higher sulphuret of sodium, while none of the sulphur existing as SO₂ is absorbed.

By calculating one equivalent oxygen for one equivalent of the sulphuric acid formed according to the first mentioned process:—



It will be found that the number calculated will express almost exactly the increase of weight found:—

Increase of weight .. 1.89 .. 4.49 .. 4.38 per cent.

SO₂+O 13.95 .. 4.44 .. 4.20 ..

It is evident that sulphurous acid does not enter into the constitution of ultramarine, and acts only by abstracting some sodium from it.

According to Gentele's observation, chlorine will answer the same purpose; Ritter used it, and found it succeed perfectly well. As sulphurous acid only forms SO₂NaO, and Cl forms NaCl, omitting mention of a trace of ClS. From this it may be concluded, with perfect safety, that the sulphur is exclusively combined with sodium. If it were combined with Al and Si, MCl and SiO₃ would be found in the aqueous extract besides NaCl, which is not the case if dry chlorine free from hydrochloric acid is employed, and if the heat is not excessively high and of long duration. This fact also proves that the NaS in ultramarine exists in real chemical combination with the silicate; otherwise it would be completely decomposed by the action of chlorine. The silicate prevents the Na Cl from undergoing decomposition, and is able to combine with NaS.

The quantity of oxygen which is absorbed may be calculated from the proportion of the sulphuretted hydrogen gas evolved by acids from the blue ultramarine. By deducting the quantity of S, which is equivalent to the absorbed chlorine from the a S of the white ultramarine, the remainder will correspond to that quantity of sulphur which should be evolved by acids. And, as for each equivalent of O afterwards absorbed, one equivalent less will appear as sulphuretted hydrogen, the quantity of S in question may be calculated from the difference between that number and that which expresses the a S of the blue ultramarine. The real quantity will be equal to half the difference, as the equivalent of oxygen is half as large as that of sulphur.

Ritter found, by analysis, blue ultramarine to be composed of:—

Silica	40.40 per cent.
Alumina	31.88 "
Soda	15.18 "
Potash	1.65 "
Na 2.39 } Na S	7.94 "
S 5.55 } Hyposulphite of Soda	1.84 "
	98.89

The amount of sulphide of sodium and hyposulphite of soda is, of course, variable, and depends on the greater or less action of sulphurous acid or chlorine.

ON METEORS.*

By Professor ALEXANDER HERSCHEL.

(Continued from page 180.)

The progress of knowledge regarding shooting-stars may almost be identified with the history of the November-star-shower. That great apparition which took Humboldt and Olmsted by surprise in 1799 and 1833, has met the gaze of thousands unable or unwilling to speculate upon its nature. Yet how aptly an Arabian chronicler of the last display describes the host of meteoric atoms invading the earth's atmosphere, as "the mighty armies of the sky joined in a fierce strife." He adds that the earth's atmosphere proved a perfect safeguard to ward off the skirmishers from the sphere of human habitations, for "the fire and sparks (he writes) were harmless, not touching the earth, or injuring our safety, as if night's daring horsemen, who continued till morning beating each other in single combat, gave us protection and peace." Thousands, again, who never saw the display of Humboldt, nor the much greater spectacle of Olmsted, have thought for themselves to penetrate its meaning. Humboldt, in his description of the star-shower at Cumana, states that the oldest inhabitants at Cumana remembered that a

* I. Dingl. Polytechn. Journal, cxlii. 351.

* From a lecture delivered before the British Association, at Dundee.

similar phenomenon preceded the great earthquakes of 1766. But no suspicion of its periodicity could then have crossed his mind for want of a statement of the month and day. On the 13th of November, 1832, and again on the 13th of November, 1833, the shower reappeared, at first in Europe, and the second time in full magnificence in America. No doubt of its periodical character could, after that time, exist. A point of capital importance was also discovered on that occasion, which distinguished the great November star-shower from all other exhibitions of meteors that had been previously observed. Instead of clashing together, as too many old accounts of their appearance might, perhaps, lead us to imagine, the November meteors, in 1833, shot outwards in smoothly-flowing lines from a single centre of emanation in some part of the constellation Leo. Olmsted himself describes the radiant point of the star-shower as the vanishing point of nearly parallel straight lines seen in perspective. The position of the radiant point in Leo was by no means unanimously fixed by different observers. Olmsted thought it near γ Leonis, but Professor Twining placed it in the centre of Leo's sickle, close to the small star χ Leonis—the identical spot where observers agreed in placing it during the November star-shower in 1866. The fixity of this point among the stars was, in the opinion of Professor Twining, sufficiently distinct to enable him to recognise that at this juncture the earth passed through a vastly extended system of meteoric bodies entirely independent of every terrestrial agency, and yet moving in entire harmony and concert,—in short, that each November meteor had an orbit, and that in their orbits they were all revolving together round the sun. Humboldt described them a little later as pocket planets, and as such they continued to be considered until their expected return, after a lapse of about thirty-three years, should enable observers, with better means at their command, and with full preparation for their reappearance, to come to a more exact conclusion.

It was soon after this that Mr. Quetelet, of Brussels, formed a catalogue of all the ancient records of star-showers that he was able to collect, in order to discover in them any signs of a periodical character that might exist. He succeeded in predicting the return of the meteors of St. Lawrence on the 10th of August, 1837, which have ever since been the most constantly observed of star-showers. The radiant point of this shower is not far from the sword-handle of Perseus. The result showed that other periodical star-showers might probably be looked for with success, and one which took place at Richmond, U.S., on the 20th of April, 1803, was watched for by Hewick in America, and was found to resemble that which from time to time appears on the 2nd of January, by great uncertainty in its returns. Its radiant point he found to be near Vega Lyræ. The other date when meteors are supposed to be most plentiful is the 2nd of January, when the meteors have a radiant point near the right knee in the figure of the constellation Hercules. A moderate shower of meteors is seen every year on the night of the 12th of December, radiating from the neighbourhood of Castor and Pollux. Finally, on or about the 19th of October, a tolerably well-marked shower of meteors has been seen during the last two years radiating in a very definite manner from Orion.

It is an interesting discovery in the familiar phenomenon of shooting stars, perhaps too long neglected, as Mr. Quetelet remarks, by astronomers, that if their number seen on any night, by one person, much exceeds fifteen per hour, the appearance generally indicates a special shower; and a very moderate amount of attention to their apparent tracks among the stars in general suffices to determine the fixed centre of radiation from which they diverge. A small degree of diligence and perseverance may thus often be profitably bestowed in rendering with very little trouble an essential service to astronomy, which would doubtless be more heeded if the beautifully striking property of shower-meteors to radiate from a fixed

point among the constellations were more generally known. From the records of scattered observations, extending over more than twenty years, the Luminous Meteor Committee of the British Association believe that they have traced the existence of at least fifty periods of such occurrences during the twelve months of the year, with the positions of their connected radiant points. But the exact date of maximum of many of the showers is still undetermined, and this is what an opportunity might frequently present itself to observers of shower-meteors to supply.

A study of ancient appearances of the November meteors led Professor Newton, of Yale College, U.S.A., to anticipate their reappearance on the morning of the 14th of November last. The interest of astronomers was awakened by the seasonable appeal in good time for preparations to be made in almost every quarter of the globe to note the reappearance of the shower. The area of its visibility extended from the British Isles to India in the east; and from Europe in the northern to the Cape of Good Hope in the southern hemisphere. This was exactly the district occupied by the same shower at its appearance in the year 1832, and it may be expected that this great shower, like that of 1833, will this year be again visible in America on the morning of the 14th November next. In that case, it will be only partially visible in Europe; but it may include some of the most brilliant parts of the shower, so as not to allow of losing the opportunity of seeing what there is. The position of the radiant point, as well as the moment of the maximum abundance was distinguished with great precision at the Royal Observatory, Greenwich, and, compared with observations at other places, leave nothing to be desired in respect of philosophical exactness. The moment of maximum frequency, observed at the Cape of Good Hope Observatory, shows that South Africa, on account of its high southern latitude, entered the densest portion of the shower about fifteen minutes earlier than the same phase of shower was witnessed in the British Isles; while the total duration of the shower, at all the stations, shows that the greatest thickness of the stream of meteoric bodies through which the earth passed in two hours was about thirty thousand miles. The inclination of the stream to the earth's orbit was also determined, whilst, by a new consent of eminent master-minds—M. Le Verrier and Professor Adams—at the end of elaborate calculations, both agreed that the true orbit of the meteoric stream is a long ellipse extending from the earth's orbit at its least, to that of Uranus at its greatest distance from the sun. The periodic time of the meteors in their orbit is thirty-three years and a quarter. The inclination of the orbit to the plane of the elliptic is about seventeen degrees, and the meteors revolve round the sun in the opposite direction to the earth. It appears that the densest portion of the group has not yet been passed through, as it occupies such an extent of length along the elliptic orbit as to require two or three years to make its passage round the sun.

A most curious incident connected with these discoveries is, that a comet detected by Tempel shortly after the first outposts of the November meteors made their appearance in 1865, to which an elliptic orbit, with a period of thirty-three years and a quarter, was assigned by Oppolzer, before the recent display of the November meteors was observed, is found to move in exactly the same orbit with the meteoric bodies, throughout their entire revolution round the sun. A coincidence so unexpected, and against which the probabilities are *a priori* so enormous, must alone make the physical connection between Tempel's comet and the group of meteoric bodies little less than certain. But the astronomer of the Brera College of Milan, Signor Schiaparelli, had already published the announcement in a letter written previously to this discovery to the Padre Secchi, that the orbits of the St. Lawrence's meteors of the 10th of August, which he supposes to be nearly parabolic, must, in that

case, coincide almost exactly with the long elliptic orbit of a very conspicuous comet, known as Swift's or Tuttle's comet, which appeared in August and September, 1862. A similar inquiry has since been made by Dr. Weisse regarding the orbit of the group of April shower-meteors, supposed, like the former, to be nearly parabolic; and this is found to coincide almost exactly with the long elliptic orbit of a bright comet which was visible for some weeks in the month of June of the year 1861.

Shower meteors thus continue to engage great attention, and by the light which their new-found relation to those most mysterious messengers from distant space, may end by throwing light upon the obscurity of the phenomena of comets.

The spectroscope has been turned with some success to analyse their light; and it was found by Mr. Huggins that the nucleus of Tempel's comet was self-luminous, shining with a single ray of bluish light; while the pale light of the envelope consisted of the sun's reflected rays. Spectroscopes of the best form that could be devised were turned towards the streaks of the November meteors; and in some of those was also recognised a single ray of a lavender blue, or of a greyish colour.

It is not impossible that the meteoric particles are portions of the comet's tails, shreds of a dismembered mist, torn by the sun's disturbing action from the nucleus of the comet, and left upon its path like embers or smoke-flakes in the track of an expiring flame. But is the heat of their collision with the atmosphere sufficient to restore a portion of the luminous appearance with which they shone in the nucleus of the comet? or are the November meteors and Tempel's comet perfect nebulae undergoing condensation, of which the meteoric bodies are the quite-faded stars, and the cometary nucleus is the still gaseous and self-luminous portion of the nebula? When the bright and persistent character of the cometic portions of the November meteor streaks is borne in mind, the telescope armed with the spectroscope may still enter the field on the eventful morning of the 14th of November next. An answer will then, if possible, be given to questions which as yet hardly admit of being rightly framed, so unexpected are the revelations, and so novel are the conceptions which a few short months have introduced into the rapidly advancing theatre of meteoric astronomy. These observations are thus given, and it is to be hoped they may prove of some value in ascertaining the character of meteors and comets. When, on the next starry shower or appearance of November meteors, the telescope or stereoscope are presented to these bright streaks, we may thus hope that answers may be given to the questions which can as yet hardly be framed—for sudden are the conceptions which have in the few past months dawned upon us in this history of meteoric phenomena.

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEETING, AT DUNDEE.

President—PROFESSOR BENTLEY, F.L.S., M.R.C.S., &c.

(Continued from page 167.)

- I. *Report on the Advantages or Disadvantages of the Employment in Pharmacy of Nitric Acid of Specific Gravity 1.5.*
- II. *Report on the Nitro Hydrochloric Acid of the British Pharmacopœia, and the Changes in it on keeping.*

By W. E. HEATHFIELD, F.C.S.

THE inquiry proposed in reference to the first of these two subjects having been rendered supererogatory, in consequence of the change prescribed in the British Pharmacopœia, which has appeared since the announcement of these questions, I pass it over with the comment that it

has been difficult to procure nitric acid uniformly of the gravity of 1.5; that it is very rarely free from a considerable quantity of nitrous acid, as evidenced when the acid is poured into water with a view to dilution; that it is uncertain in strength, from its tendency to decompose, and that it is inconvenient to pack, dangerous in transit, and unmanageable in use. The acid of the British Pharmacopœia of 1867 is doubtless an excellent substitute, containing, as it does, 70 per cent. of monohydrated acid, this water being combined with the acid as a base, whilst the accompanying 30 per cent are in such a state of combination as to be termed the constitutional water. It undergoes no change on keeping.

Referring to the second inquiry,—the nitro-hydrochloric acid, and the changes in it on keeping,—it is to be observed, that since the institution of these experiments, the British Pharmacopœia of 1867 has been presented, with an alteration in the formula and directions for the production of this acid, which yields the following results:—The specific gravity of the two acids, on admixture, and, after cooling, was 1.277, but on standing for 24 hours as directed, was 1.268. On adding the quantity of water for the production of the dilute acid, the specific gravity was found to be but 1.063, and 352.4 grains, or 6 fluid drachms, required but 840 measures of volumetric solution of soda for neutralization.

This experiment having been conducted with a view to determine the loss of hydrochloric acid consequent upon leaving the mixed acids for twenty-four hours, the operation was conducted so that on the mixture of the two acids in a loosely-stoppered bottle, the escaping chlorine should be collected under a bell-glass, and should be received into a solution of potassa. This solution, at the end of the twenty-four hours, was subjected to estimation by means of nitrate of silver, and was found to be charged with chlorine, which, calculated as hydrochloric acid, was found to be in such a proportion as to have diminished the strength of the nitro-hydrochloric acid by about 3 per cent. The loss of nitric acid was not estimated.

Proceeding somewhat differently, with a view to the production of dilute nitro-hydrochloric acid, the following process was adopted:—The proportions of acids ordered in the Pharmacopœia of 1867 were united, and, on cooling, the specific gravity was 1.277. The water was then added, and the specific gravity was 1.074, thus corresponding to the theoretic gravity of the Pharmacopœia of 1864. 352.4 grains required 1,000 measures of volumetric solution of soda. This experiment was made on the 31st of May, and the tests were again applied on the 29th of August, when no variation had taken place, thus proving that the diluted acid was not impaired by keeping for a moderate length of time.

Whatever may be the estimation in which the process for the production of diluted nitro-hydrochloric acid is held, it is clear that it can scarcely attain the result desired, viz., uniformity. If the acids are mixed as directed, there must necessarily be loss, for it is not easy to imprison the escaping vapours, and an explosion would be likely to occur in a bottle well stoppered; in one not so, as directed, the escape of vapours is considerable, as indicated by the experiments detailed in this paper.

"Notes on Tinctura Opii and Liq. Opii Sedativus."

By Mr. ALFRED SOUTHALL, Birmingham.

IN continuation of a subject which was brought forward at the last meeting of the Conference, viz., the analysis of various specimens of ordinary commercial opium; in order, further, to show the extremely uncertain medicinal value of different samples, I have since examined a variety of specimens of tincture of opium, some of which have been kindly forwarded to me by Dr. Attfield. These specimens were, I believe, procured indiscriminately from the establishments of various pharmacists, and show a variation in strength which may well rather alarm the prescriber for the welfare of his patient.

Taking the standard of strength required by the British Pharmacopœia, which states that 100 grains of opium should yield at least 6 to 8 per cent of morphia, the consequent strength of tincture of opium, B.P., should be not less than 0.5 per cent of morphia. The following is my result of nine samples of tincture :—

No. 1 specimen contained 0.3 per cent of morphia.

" 2 "	" "	0.5 "	" "
" 3 "	" "	0.6 "	" "
" 4 "	" "	0.5 "	" "
" 5 "	" "	0.2 "	" "
" 6 "	" "	0.5 "	" "
" 7 "	" "	0.4 "	" "
" 8 "	" "	0.7 "	" "
" 9 "	" "	0.5 "	" "

Good commercial opium, such as is commonly found in the English market (as our analysis last year showed), contains frequently as much as 10 to 13 per cent of morphia; and the Pharmacopœia, laying no restriction upon a maximum yield of morphia, opens a wide door for a great diversity in the strength of its opium preparations, so that a tincture yielding from $\frac{1}{3}$ to 1 per cent of morphia is within the Pharmacopœia limits.

Although liq. opii sedativus is not officinal, yet this form of administering opium is scarcely less important than the tincture. It is, however, interesting to notice in the analysis of the eight following samples, that the same wide diversity exists :—

No. 1 specimen contains 0.6 per cent of morphia.

" 2 "	" "	1.2 "	" "
" 3 "	" "	0.7 "	" "
" 4 "	" "	1.0 "	" "
" 5 "	" "	0.5 "	" "
" 6 "	" "	0.8 "	" "
" 7 "	" "	1.5 "	" "
" 8 "	" "	1.1 "	" "

"Remarks upon the Uses of Bisulphite of Lime in Pharmacy."

By WENTWORTH LASCELLES SCOTT, F.C.S., &c.

I have undertaken to lay before the British Pharmaceutical Conference, in a few words, the results of some experiments instituted with the view of discovering a means of preventing the rancidity and decomposition to which various ointments and fatty preparations are liable, if kept for any length of time.

A series of specimens of freshly-made spermaceti and other ointments, cold cream, bear's grease, and simple lard, were placed in similar pots, and allowed to rest in a warm situation; a duplicate series, to which a very small proportion of bisulphite of lime had been added, being put by the side of the first.

In the course of six or seven months, most of the first series had become more or less decomposed; they had an acid reaction and disagreeable odour, while those to which the bisulphite had been added remained absolutely fresh and sweet. In consequence, I now treat all preparations of fatty or oleaginous substances with a little of this salt, applied in the form of strong solution, and have never yet found it to fail.

For ointments, a fluid drachm to each pound is quite sufficient to preserve them, while it has no injurious action whatever, and is quite compatible with the great majority of ointments and oily preparations,—a remark which does not apply to the alkaline sulphites or bisulphites which have from time to time been brought forward for similar purposes.

Beef-tea or broth in hospitals or otherwise may be prevented from turning sour by stirring in a few drops of the bisulphite of lime solution to each pint of the soup; and the same plan will enable us to keep jellies, which ordinarily decompose so rapidly in the organic germ-laden

air of the sick-room, for many days unimpaired; these are, in my opinion, considerations of some moment in all circumstances, but most especially in the habitations of the poor.

Clothes or matting, soaked in the same solution and hung up, act as disinfectants of the most effective kind, and do not exhale the peculiarly unpleasant odour of carbolic acid, or the irritating vapours, so distressing to the bronchial system, of chloride of lime.

I have successfully employed the bisulphite of calcium for the preservation of numerous anatomical and other specimens, as it does its work perfectly, and without occasioning the great changes of colour and contraction of muscular structure so frequently produced by ordinary antiseptics; moreover, its special advantage over the preparations of mercury and arsenic lies, to my thinking, in the fact that it is not poisonous, and can therefore be handled with perfect safety.

There are numerous substances employed in pharmacy,—such as musk, castoreum, lard, and other fatty matters,—which are more or less injured by decomposition or keeping for any length of time. To these the bisulphite can be applied with considerable advantage.

Notes on the Use of the Microscope, and its Crystallographic Application.

By W. W. STODDART.

After referring to the history of the microscope, the author spoke of it as a source of the greatest assistance in saving time, by indicating what the chemist afterwards verifies with his reagents.

The analytical chemist will tell you to the uttermost part of a fraction the proportion of C, H, O, Ca, K, &c., but he cannot tell in what state of combination they existed till the lens shows the granules of starch or the vegetable cell. The mineralogist would know that his tripoli was silica and alumina, but how could he possibly guess that it was composed of myriads of elegant and most beautifully-sculptured vegetable skeletons? So with the retail chemist; how (without the microscope) would he be able to tell that his wholesale brother had been putting bean-flour with his fænugreek, or lignum vitæ with his jalap?

A good example of the large amount of knowledge obtainable in a short time, and very commonly required from the dispensing chemist, is in the examination of urine or urinary deposit. We will suppose a clear example to be given with no apparent deposit. Evaporate and ignite a few drops on a bit of platinum foil. While this is going on put a drop of the secretion on a glass slip with a very little nitric acid, when in a few minutes crystals will appear, which under the microscope show the well-known rhomboids of *nitrate of urea*.

Examine another drop as it is under a quarter-inch lens, when *oxalate of lime*, epithelial scales, &c., may be detected. Now dissolve off the ash left on the foil with a drop or two of distilled water. Place a drop on two glass slips. To the one add the smallest quantity of ammonia, and dry. The lens will then show *phosphate of lime*, *triple phosphate*, and *chloride of sodium*. To the other drop add bichloride of platinum, and evaporate to dryness. If *soda* be present, you will have acicular crystals of the platino-chloride; or if *potash* be there, you will find cubical crystals of the corresponding salt. Thus, in a few minutes, by the aid of the microscope, no less than seven distinct salts may be readily detected, besides a great number of others.

Few fluids can be found, whether natural or artificial, whether a secretion or a chemical solution, that do not contain substances which, by some means or other, may be made to separate as crystals. Now, as these crystalline attributes are so universal and constant, the author has founded on it his method of determining the name and nature of the crystalline constituents of a given

fluid,—a method by which, without any chemical test, but simply a microgoniometer, the name may be determined.

Crystals may be obtained from a given solution for microscopical purposes in six different ways, no matter how small the quantity may be:—

1. By simple deposition by cooling; as the well-known triple phosphate, so often seen in animal secretions.

2. By precipitating a salt in a comparatively insoluble form; as the sulphocyanide of strychnia or bitartrate of potash.*

3. By fusion; as in the case of salicine and several of the alkaloids.

4. By galvanic deposition; as in the detection of lactic acid.

5. By sublimation; as in arsenious and benzoic acids, thein, &c.

6. By evaporation.

In all the previous methods the object usually is to obtain *separate* and characteristic crystals, whose natures are only to be known by their peculiar form or confirmative testing. By the mode now to be described the author has obtained certain results which, as they have not hitherto been published, he wishes now to lay before you, hoping that to some they may prove useful.

A drop of the given solution is placed on a glass slip, and slowly evaporated over the flame of the spirit-lamp, or in a drying chamber. A crystalline residue is left which, to the eye only, appears simply a magma of crystals without any definite arrangement. From a careful study of these, considerably magnified, the author noticed a certain arrangement of lines peculiar and constant to every salt. Again, on every slide it will be noticed that two angles always predominate over the others, and that the same salts have these two angles invariably the same. It is thought, therefore, that a table might be constructed from these angles, so that a measurement and reference to the table would give the name of the salt.

The goniometers used by the author are that made by Ross and that invented by Dr. Leeson; the latter being more correct, while the former is more easily used.

Ross's goniometer is a positive eye-piece, across the field of which is a very fine line, the whole being made to revolve in a circle very finely graduated. When used, the engraved line is placed over or parallel to one side of the angle to be measured. The line is then revolved by means of the rackwork till it coincides with the other side of the angle, when that portion of the graduated arc traversed by the vernier gives a very correct measurement of the angle required.

The beautiful instrument of Dr. Leeson is an ingenious application of the phenomena of double refraction. It is equally adapted for measuring opaque or transparent crystals, microscopic or the largest crystals. It consists of a double refracting prism of Iceland spar, which is mounted over the eye-piece, and the whole fitted into a very finely-divided circle. When, therefore, the crystal is viewed through this prism two angles are produced, which revolve round each other as the prism is revolved. The amount of rotation, when applied to the angle, gives the measurement required.

The author feels that he has not worked out the subject as it deserves; indeed, so much more work remains to be done, requiring more time than he has at his disposal, that having made public the *modus operandi*, he hopes some one will continue its development.

Table of Angles.

Name of Crystal.	Predominating Angles.			
Sulphate of magnesia	120°	4'	105°	
Bicarbonate of potash	90°		128°	5'
Nitrate of potash	76°	30'	103°	30'
Ammonia alum	90°		120°	
Tartaric acid	97°	10'	83°	30'
Oxalic acid	74°	2'	106°	8'
Cholesterine	79°	30'	100°	30'

Mr. C. Kerr, of Dundee, read a paper on the interference of the excise in the sale of quinine wine, observing that something must be radically wrong, when chemists were made to pay license for making medicated wine with British wine, and not for making them with foreign wine; and now that quinine wine is a preparation of the British Pharmacopœia, he proposed that the Excise Board be communicated with on the subject.

INTRODUCTORY ADDRESS

DELIVERED AT

ST. BARTHOLOMEW'S HOSPITAL MEDICAL SCHOOL.*

SESSION 1867-68.

By WILLIAM ODLING, M.B. Lond., F.R.S.,
Lecturer on Chemistry at the Hospital.

I HAVE dwelt largely upon the importance of your acquiring the utmost attainable knowledge of disease, in order that you may be able hereafter to deal with disease. You are now for a few years, and must indeed continue to be all your lives, students of medicine, so as to become and continue practitioners of medicine. With you, as future practitioners, knowledge is only a means to an end, and that end the cure of disease. The medical man is a medical artist; and his ultimate object is, not to accumulate knowledge, but to multiply cures. As practitioners of medicine, then, you are called upon, not only to know, but to act. Now, as was so clearly pointed out last year, in almost every concern of life in which action has to be taken, we do not act with an absolute certainty, either of the state of affairs under which we act, or of the result that will follow our action, but upon a probability only, approximating more or less to the value of an absolute certainty in different cases. And, if we are judicious men, we are all the more cautious in acting in proportion to the importance of our act, and the inferior certainty of our knowledge. The practice of medicine, indeed, like that of any other art, may, in various ways, be good or bad, judicious or injudicious, skilful or unskilful; but, to act skilfully, it is above all things necessary for you to act with a well-founded and well-applied judgment, alike as to the conditions and consequences of your act. For this purpose, you must have an experience of cases on which to found your judgment of any particular case, and also an experience in the application of your judgment to the features of different cases. And this double experience by which you will be enabled to appreciate what is required, must be further supplemented by an experience in effecting what is required. Skill in ascertaining how matters stand, skill in perceiving what is desirable, and skill in effecting what you desire, can only be attained by constant practice in ascertaining, perceiving, and effecting. In other words, so as to express an obvious truism, for the skilful practice of medical art you must be practical men; not, indeed, as distinguished from scientific men—not as being unacquainted with the science of disease, but rather as having pursued your knowledge of that science to its most special developments, and familiarised yourselves with its most special applications. As practical men, having that prompt understanding of what is required to be done, and how to do it, which continuous practice alone can impart, you may, perhaps, have something in addition to the merely scientific man, but assuredly nothing in contradistinction to him. Mentally, indeed, we may dissociate the science from the art of medicine; actually they are one and indivisible. Science is knowing; art is doing or practising; but it is quite impossible to

* Extract, communicated and corrected by the Author

know the science without practising the art, or to practise the art without learning the science of medicine. Of course, the scientific man, though possessing a knowledge of all the sciences under the sun except the science of medicine, wanting the knowledge of that, can never be a physician. And the knowledge of medicine, like any other branch of natural history knowledge, can only be acquired by working at the subject of that knowledge—that is to say, by attending to the practice of medicine and the investigation of disease. For the successful practice of medicine, then, as for the practice of any other art, that particular kind of intimate personal knowledge which results from or constitutes personal experience, is most of all required; since the conditions affecting disease in any particular case are so various that nothing but experience will enable you to estimate them even approximately.

And now, gentlemen, what has been the object of my address? It has been to satisfy you of the reality of medicine as a branch of human knowledge, and of the soundness of medical practice in so far as it is based upon knowledge and philanthropy. Every branch of human knowledge is necessarily incomplete, and very much in proportion to the complex and recondite character of the phenomena with which it concerns itself. As a consequence of its incompleteness, every branch of knowledge is more or less tainted with error; and much unsuspected error doubtless prevails and will prevail in medicine. But the strength of our position is this, that we are desirous only for the establishment of truth. Our present views are merely the resultant of our present knowledge, and are held by us on the express tenure of changeability with greater certainty of knowledge. To acquire this greater certainty, our method is to consider, observe, and investigate phenomena; not, indeed, without an expectation of finding—not even without some unphilosophical wish to find—that the truth may lie in a particular direction; but still with the single-minded intention of learning what the fact of the matter is, and of loyally accepting it.

It is thus that our present knowledge of medicine has been established by the same method as the knowledge of every other branch of natural science; and many investigations in practical medicine will take their place amongst the finest examples of scientific work recorded. Allowing also for the different character of its subject, much of our knowledge with regard to disease will bear the most searching examination to which any branch of knowledge can be exposed; and there is no part of our professed knowledge that we fear to submit to the most rigorous ordeal, since we derive no less benefit from its refutation than its confirmation. As students of nature, we have no system of medicine to stand or fall by; for the physician, of all men in the world, is essentially *homo nature minister et interpres*, and nothing more. He no longer looks upon himself as the depository of some occult mystery, but as a mere student of nature; whose knowledge, indeed, so far as it goes, is a real knowledge, but who aspires to and incessantly strives for the attainment of more perfect knowledge.

The knowledge of diseases, however, is a plant of slow growth. You cannot complete the knowledge here; you can, indeed, do little more than lay the foundation for it; and the sounder and broader your foundation, the greater the degree to which you will hereafter be able to extend your knowledge. But to understand disease aright, as to understand every other phenomenon of nature, you must not only study the disease itself, but must also prepare yourselves for such study by the acquisition of extensive preliminary knowledge. It is most unfortunate that, from the defective state of physical education at schools and colleges, much of the preliminary knowledge which you ought already to possess, you will have to acquire here, whereby valuable time, which, in this home of disease, could be advantageously devoted to the work of your profession, will be seriously encroached upon; and, after all, you will not obtain such a knowledge of general

science as you ought to possess, and which—in the forcible language of Prof. Huxley—you would possess “if those who regulate education in this country had a right conception of what their duties are, or of the purpose of education, and the conditions of the progress of mankind at the present time.” By rights, I maintain, no one should be allowed to enter at a medical school without having a competent knowledge of the three great divisions of natural science—namely, physics, chemistry, and biology; whereby our distinct courses of comparative anatomy, of botany, and of general chemistry and physics, might be abolished from the curriculum of hospital study, as deriving no advantage from their association with hospital work. Chemistry, indeed, as the basis of vital dynamics and sheet-anchor of rational therapeutics, must ever form an important branch of medical education. But the sort of chemistry which should be taught—in our own chemical theatre, for instance, and in that magnificent laboratory which you, Sir, have lately had constructed—is very different from the chemistry which I am in the habit of teaching, and shall, I fear, long continue to teach. It should be an altogether special development of chemistry, having to the chemistry ordinarily taught much the same relation that the study of human anatomy and physiology has to the study of biology in general, and having a scarcely less direct bearing upon your strictly professional duties.

But you must make the best of circumstances as they exist, and endeavour, while here, to obtain as much preliminary science as you can. In your future careers you will necessarily have to compete with men far more experienced in disease than yourselves, and your only chance of competing with them successfully will consist in compensating as far as may be for their superior experience, by starting upon a surer foundation of medical knowledge than was possible to them at the outset of their careers. But all your preliminary knowledge must culminate in your acquiring an ultimate knowledge of disease, and the ultimate branch of your knowledge is just as scientific as the preliminary. If you content yourselves with laying the foundation—if you neglect to raise the superstructure,—you cannot be called physicians. In that case, and in that case only, will you be at a disadvantage with the so-called practical man, whose superstructure at any rate exists, though based on a much less certain foundation, and constituting a far more rickety edifice than yours might be. You cannot, I have said, complete your knowledge of disease during your study here. You may, nevertheless, among the out-patients, and in the wards, and more especially in the dead-house, of this great hospital, learn that of disease which, neglecting to learn here, you will never be able to learn elsewhere. Here alone can you acquire the art of examining disease in the living; here alone can you examine the results of disease in the dead.

The knowledge, then, both preliminary and professional, you will have to obtain during your few years of hospital study is enormous in its amount, and in its kind not only most various, but for the most part very different from any to which you have previously devoted yourselves. It is lamentable that this should be the case, and reflects seriously upon those on whom the charge of general education in this country chiefly depends. Both as regards the attainment of real knowledge, however, and the training of your powers of observation, your judgments, and your understandings, many of you will, I believe, gain more during your first year of study here than during the last half-dozen years of your previous lives. But to achieve this gain, you must work laboriously and continuously. Even the ablest of men cannot afford to dispense with work. I have set before you the career of Sir William Lawrence, not, perhaps, as an example to you in every respect, for men of his extraordinary powers could not fail of success in any walk of life, and might safely neglect the special requirements demanded by any particular walk. But even he would never have

succeeded, either in surgery or any other profession, without work. Referring to Lawrence in his student-days, Sir Benjamin Brodie wrote of him, some fifty years afterwards, "I never knew anyone who had a greater capacity of learning than he had, or more industry." I have said that the amount of knowledge you will have to acquire is enormous. Still it is not more than can be acquired, or more than habitually is acquired, by industrious men, an appellation which all of you must make it a point to deserve. Remember that the period of your sojourn here is the most important period, is indeed the seed-time, of your lives. With a view to the harvest of ultimate success in life, if for no nobler object—for the sake of your own future happiness and self-respect, still more for the welfare of those committed to your charge, take care that that time is not misspent or frittered away. What you may if you please secure now, you will never be able to attain hereafter. Let me then entreat you to make the most of your present opportunities. Let me say to each one of you—

"Stay, stay the present instant!
Imprint the marks of wisdom on its wings!
O, let it not elude thy grasp, but, like
The good old patriarch upon record,
Hold the fleet angel fast until he bless thee!"

REPORTS OF SOCIETIES.

PHARMACEUTICAL SOCIETY.

FIRST MEETING OF THE SESSION.

Wednesday, October 2, 1867.

T. H. HILLS, Esq., Vice-President, in the chair.

SEVERAL donations to the library and museum were announced, and the thanks of the meeting given to the donors. Amongst them were some well executed drawings by Mr. Brady, illustrating the appearance of quinodine, the urinary deposits, &c., under the microscope.

The CHAIRMAN then proceeded to present to the successful competitors the prizes and certificates of merit awarded at the conclusion of the last session, first calling upon the Professors to report the results of their respective examinations.

Professor REDWOOD reported the results of the examinations in chemistry and pharmacy, and in doing so he spoke very highly of the conduct of the class, both as regards attendance and behaviour.

Professor BENTLEY, in reporting the results of the examination in botany, also alluded to the exemplary conduct of the pupils, as well as to the progress they had made.

Professor ATTFIELD reported the results of the examination in practical chemistry, which were very satisfactory. In speaking of examinations, he said they were not the best proofs of a man's qualifications, although they are the best we possess. Knowledge gained by practical experiments was more lasting than that derived solely from books.

The CHAIRMAN then gave some excellent advice to those who had received the prizes, speaking of the good they would receive by attending the meetings and rallying round the Society. He had attended the meetings regularly for a number of years, and never went home without deriving some good.

Mr. MORSON made some remarks upon a remarkable case of the crystallisation of borotartarate of potash. A solution of borotartarate of potash had been placed in a bottle previous to its being converted into scales. On examination it was found to have become solid, and retained the shape of the bottle, which was broken. He had mentioned it to Dr. Redwood, who would give them the results of his experiments.

Professor REDWOOD said that borotartarate of potash, or soluble cream of tartar, was considered an uncrystallisable

substance. It was obtained by making a solution of boracic acid, or borax, and cream of tartar, and evaporating to dryness, or, if required in the form of scales, it was evaporated to a syrupy consistence and laid upon plates. He had examined it under the microscope, and made several experiments, but had not been able to discover why it had assumed such an unusual form.

Dr. ATTFIELD made some remarks, in which he suggested that a quantitative analysis might throw some further light on the subject.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, OCT. 9, 1867.

Deep Engraving without Varnish—Spectrum of the Flame of the Bessemer Converter—Analogy of it to Stellar Spectra—Spectrum of the colour of Water and Ice through great thicknesses—New Voltaic Piles—The Pascal-Newton Forgeries.

METHOD of obtaining deep engraving and reliefs without varnish, by Mr. Joseph Balsamo, Professor of Physics at the College of Lecca, Italy. Starting from the fact that by pressing the finger on different points of a vibrating plate, a great variety of reliefs and bosses are formed by the distribution of sand at the surface, M. Balsamo thinks that pressure obtained on different points of a plate immersed in a galvanic bath would modify the deposit of metal at the surface. Experiments have confirmed his theory, and the mode of operation is as follows:—In a solution of acetate of iron, to which has been added some grammes of phosphoric acid, and some fragments of phosphorus, he plunged two plates of common iron, communicating one with the negative pole, and the other with the positive pole of a Bunsen battery of three elements. Between the two plates, and perpendicularly to their surface, a blade of glass is fixed, 210 millimètres long and 35 wide, so as to press by its edges the two plates suspended at the two poles of the pile. In order to better establish the contact between these two iron plates and the edges of the glass blade, he drives in two edges of wood, one on each side, between the sides of the vessel containing the ferruginous solution and the exterior surfaces of the metallic blades. After two days of voltaic action, the metallic iron is deposited on the blade suspended at the negative pole in parallel vertical bands on the two sides of it, a hollow groove alternating with a ridge in relief. The hollows correspond to the space occupied by the edge of the glass sheet, and the reliefs on the sides of this same plate. The vacant lines, that is to say, those on which the metallic iron is not deposited, were in consequence the nodal lines, the full lines on which the iron was precipitated were the reliefs, or lines of vibration.

M. Balsamo has substituted for the straight piece of glass a curved one of an S shape, so that the points of contact of the glass can form a slight sinuosity, and the iron is deposited in sinuous planes alternating with sinuous hollows. In forming the designs with the aid of glass or clay, porcelain, &c., all the parts in contact with the edges of the design will be reproduced as many times, on the same surface, as the free space left by contours is more extended. Damask work, designs in engraving or in relief work, repeated on the same surface, can be obtained thus by a simple application of the negative type against the blade suspended at the positive pole. In place of acetate of iron we can employ other solutions of iron or metallic salts.

In a communication to the Italian Society—called the Forty—of Modena, Father Secchi made the following very interesting and curious observation on the spectrum of a terrestrial flame that struck him as very similar to the spectrum of certain yellow and red stars. This flame is that which proceeds from a converter in which Bessemer steel is being made; and this spectrum, well known by

directors of iron works, when the iron is completely decarbonised, presents a series of very fine and very numerous lines or streaks which remind one of α Orionis and α Herculis, only that it is reversed. This results, undoubtedly, from the great number of metals burning in the flame, and the spectrum presents several lines well known and determined; also, this flame seemed to be the only one comparable with that of the coloured stars, and there is nothing improbable in this fact when we consider the composition of aerolites in which iron predominates. But what is most important in our terrestrial flames, we have a fertile and abundant field of observation of spectra which are closely allied to those of certain stars. M. Secchi states that he is indebted to M. Lemonnier, director of the Terre-Neuve Works, near St. Etienne, for this observation.

M. Secchi had formerly ascertained that the spectrum of the colour of sea water is deprived of its red portion at small depths, and successively of the yellow and green, at least partially, for the greater depths, and then it appears of a violet blue. He tried to find out whether the same was the case in glaciers, and made some interesting experiments in an artificial grotto in the Grindenvald glacier. This cavern was 100 mètres deep, transparent in its walls, through which the solar light penetrated. This light was of a fine blue tint. In this shade of colour the red was extremely weak, so that in this grotto human countenances had a cadaverous aspect almost alarming. On looking towards the entry, at a certain distance in the cavern it appeared to be lit up with a red light, undoubtedly the effect of contrast. The thickness of the superposed mass was not enough to show a greater effect than the almost complete absence of the red, and a great diminution of the yellow. The ice was said to be 15 mètres thick, but it was probably less. The ice was perfectly compact, limpid as crystal, but with a few air bubbles. The hardness was not considerable.

At the Academy of Sciences, on the 23rd ult., M. Peligot presented, in the name of M. J. E. Balsamo, a memoir on the unipolarity of iron in liquids, and a new voltaic pile.

The pile is formed of two blades of iron, one plunged in dilute sulphuric acid, the other in a solution of chloride of sodium separated from the acidulated water by a porous diaphragm. The iron of the acidulated water acts as zinc, and that of the saline solution acts as copper. The current, constant and of considerable intensity, proceeds from the property possessed by iron of polarising itself differently in certain solutions between which osmogenic action takes place.

If two blades of iron of the same molecular constitution be suspended at the two poles of a galvanic bath (acetate of iron and phosphoric acid) animated by the current capable of decomposing the salt of iron of the bath, the plate suspended at the positive pole will be attacked as usual, while the blade suspended at the negative pole is covered with a homogeneous and thick coating of iron. Experiments have proved that the first iron is electro-positive, as zinc, and that the second acts electro-negatively, as copper; perhaps it is because the iron suspended at the positive pole is combined with a small quantity of phosphorus. M. Balsamo plunges, at the same time, in oxalic acid, two small magnetised bars of the same surface and of the same weight, one having its north pole in the liquid and its south pole out of it. The second bar is in the contrary position. The first acted as zinc, the latter as copper, and a current of electricity was the consequence.

The insertion in the CHEMICAL NEWS of the letter of Mr. Robert Grant makes us revert to the question of the authenticity of M. Pascal's letters. The long discussion of Mr. Grant only proves one thing, and that is, that the figures in the notes of Pascal are those of the third edition of the *Principia*; or, rather that Newton has only inserted in his third edition the figures that he had received in 1658. It does not prove at all that Pascal was not in possession, or could not be in possession of observations exact enough to deduce the figures of the notes. He

does not demonstrate either the astronomic authenticity of the figures which should serve as a base for the calculations of Newton.

But M. Chasles has brought to light letters from Galileo, Flamsteed, Huygens, Polignac, &c., &c. We are also informed that the observations which have served as a basis to Pascal's calculations come from Kepler and Galileo, but the figures in the third edition of the *Principia* (1760) come from the hands of Galileo, who had them, as he declares, from Pascal.

To resume: 1. Acquainted with the fact that the essential difference between the writing in the autographs and that of the authentic letters of Newton consisted principally in the conformation of the *c* and *d*, M. Chasles has shewn that many of these documents had the two characteristic forms required. 2. These autographs date evidently as far back as the 17th century, and contain four authentic signatures of Newton. Sir David Brewster affirms that after a publication brought out in this century in the General Dictionary, or the Macelesfield Correspondence of 1841, these signatures were made. 3. Messrs. Hirst and White, thinking that they had made a discovery, and proud of finding in the collection of Desmazeaux and Clarke the text of the notes of Newton, did not expect to learn from M. Chasles that Desmazeaux, whose collection he has, only reproduced the documents passing through his hands, and that Newton sent, under the form of notes to Clark, arguments in favour of Leibnitz. 4. M. Grant finds in the third edition of the *Principia* in 1725, Pascal's figures purposely different from those of the second edition, but he was not aware that the same figures were attributed in 1760 to Pascal by an authentic letter of Galileo. F. MOIGNO.

CORRESPONDENCE.

THE SODA TRADE.

To the Editor of the Chemical News.

SIR,—In answer to the remarks of "A Practical Chemist" in your last impression, I beg to observe that the practice stigmatised as a "barefaced fraud" is not so much the mere use of 24 as the equivalent of sodium, as the habitual invoicing of sales of soda ash as containing a considerably higher percentage of available alkali than that really present. To take an example: pure Na_2CO_3 contains (on the supposition that $\text{Na}=24, \text{C}=12, \text{O}=16$) 59.26 per cent of Na_2O ; whilst of $\text{Na}=23$, it contains 58.49, the difference between the two being 0.77 per cent out of 59.26: on a 48 per cent ash, accordingly, the difference would be $\frac{58.49-59.26}{59.26} \times 0.77$, or 0.62 per cent; that is, the real percentage would be 48-0.62, or 47.38 per cent. If, however, such ash were invoiced at 2 per cent above its real strength, it would be called 49.38 per cent—say 49 per cent; and if the commercial analyst referred to by either party adopted such a mode of computation as would allow this invoice to pass unchallenged (and the writer has known many such instances), the result would be that the purchaser would pay for 49 units, whilst the ash, even on the supposition that $\text{Na}=24$ only contained 48 units; accordingly, it does not appear a very extravagant statement that in this case the purchaser is "defrauded."

If the taking $\text{Na}=24$ were a point simply affecting trade customs, it would be of no more material consequence than the selling of some goods by the ton of 20 cwt. and others by the ton of 21 cwt.; but as none of the higher class of chemists accept this equivalent, and as there is no reason whatever to be assigned for its retention, whilst, in addition to the scientific inaccuracy, there is the objection that it opens the way to disputes, and is the cause of considerable discrepancies in the analysis of the same

substance by different analysts, it is evident that the abolition of this custom would ultimately be attended with advantage to the manufacturer, and would also tend to raise commercial analysts from the somewhat low position they unfortunately hold at present.

With respect to the iron process for bleaching powder determinations, I have only to remark that visibly effloresced crystals of ferrous sulphate are uniformly more or less peroxidised, and are totally unfit for use. With pure chemicals and careful manipulation I have always obtained precisely identical results with both the iron process and the sodium arsenite process, in the absence of chlorate in the sample analysed.—I am, &c.,

CHARLES R. A. WRIGHT, B.Sc.

Edinburgh, October 5, 1867.

To the Editor of the Chemical News.

SIR,—I have read with much pleasure the communications of Mr. Wright, giving us, as they do, a brief glance at all the methods capable of being employed in commercial determinations. As he does not mention it, I think the process I employ for the determination of manganese must not be generally known. I place a given weight of the manganese with HCl in a small flask with a leading tube attached. I absorb the Cl by means of a solution of NaOCO_2 , using an inverted retort for a condenser; then by means of a solution of arseniate of soda I estimate the Cl, and thus arrive at the percentage of MnO_2 ; or rather I have prepared a set of tables for this and other determinations, by referring to which I can without calculation, or at least with the simplest possible, arrive at what I want. Of course I claim no credit for this adoption. The thing appears so obvious to substitute two commonly occurring materials for the KI and SO_2 of Bunsen's process, that I should have supposed it in use in every laboratory where such determinations were made.—I am, &c.,

P. H.

MISCELLANEOUS.

Forthcoming Scientific Books.—Amongst Messrs. Churchill's literary announcements for the ensuing session we find the following:—

"The Microscope and its Revelations." With 400 plates and wood engravings. By W. B. CARPENTER, M.D., F.R.S. Fourth edition.

"Companion to the British Pharmacopœia of 1867," comparing it with the Pharmacopœias hitherto used in Britain; including that of 1864; also the new editions of the U.S., the French, and the Prussian Pharmacopœias. By PETER SQUIRE, F.L.S. Fifth edition.

By the same author, "The Pharmacopœias of the Principal Hospitals of London." Arranged in groups for easy reference and comparison. Second edition.

"Germinal Matter and the Contact Theory. The key to the prevention and study of zymotic disease." By JAMES MORRIS, M.D., Lond. Second edition.

"Urine, Urinary Deposits, and Calculi, and on the Treatment of Urinary Diseases." With numerous plates. By Dr. LIONEL S. BEALE, F.R.S. Third edition, very much enlarged.

"Chemical Notes to the British Pharmacopœia of 1867." By CHARLES HENRY WOOD.

"The Induction Coil: being a Popular Explanation of the Electrical Principles on which it is constructed." With a series of beautiful and instructive experiments. By HENRY M. NOAD, Ph.D., F.R.S., F.C.S. Third edition, with engravings.

"On the Action and Use of Oxygen. With selected cases proving its value in the treatment of various intractable diseases." By S. B. BIRCH, M.D., M.R.C.P., Lond. Second edition.

"The Calendar of the Pharmaceutical Society of Great Britain."

"First Lines for Chemists and Druggists preparing for Examination." By JOHN STEGGALL, M.D. Third edition.

"On Local Anæsthesia and Volatile Fluid Spray in Medicine and Surgery." By BENJAMIN W. RICHARDSON, M.D., F.R.S.

"The First Step in Chemistry: a new method of teaching the elements of the science." By ROBERT GALLOWAY. Fourth edition.

The Borax Company, engaged in taking out borax, in Lake county, will soon be in condition to extract five tons of this article per day from the borax lake, as they have just received a new and powerful steam dredger and an immense pump, with which to exhaust the water from the coffer dams. This pump weighs something over 1,000 pounds, and is to be worked by steam.—*Mining and Scientific Press.*

Poisoning by Caustic Potash.—A death has recently occurred at Pendleton, caused by drinking the contents of a jug supposed to contain porter, but which in reality contained a solution of caustic potash. The deceased drank it on the 22nd May, and lived until the 20th September. Mr. Heywood, surgeon, Pendleton, who had attended the deceased, stated that he had been unable to swallow anything during his illness, and he attributed death to starvation in consequence of that inability. He had made a *post-mortem* examination of the body, and found a stricture of the œsophagus, extending over four or five inches, rendering swallowing an impossibility. The injury had been caused by taking caustic potash.

The Atmosphere of the Metropolitan Railway.—The inquiry respecting the death of E. Stainsby, who died on the 28th of August, at the King's-cross station of the Metropolitan Railway, after travelling from Bishop's-road station, was resumed on Friday last by Dr. Lankester. The inquest had been twice adjourned for the purpose of having scientific evidence as to an analysis of the atmosphere in the tunnels of the railway laid before the jury, so as to lead them to a just conclusion as to whether the death of Elizabeth Stainsby was accelerated by the condition of the atmosphere in the railway between Bishop's-road and King's-cross stations. The Coroner said he had received a communication from Mr. Fenton, the general manager of the Metropolitan Railway Company, in which he stated that the scientific evidence which the company wished to lay before the jury was not yet completed. The scientific referee whom he (the coroner) had appointed, had he believed, completed his experiments, but still he thought it well that the jury should have the whole evidence before them in order that they might arrive at a right conclusion. He had received assurances from a great many persons that the ventilation of the Metropolitan Railway had been much improved. Therefore, setting aside any result at which the jury might arrive as to the death of Elizabeth Stainsby, it appeared that from the fact of the deceased and others having complained of the atmosphere of the railway, the directors had done something to remedy the evil. Therefore, the jury would not feel that their time was lost in keeping a watch over this railway for the benefit of the public. It had been said that the jury and he were unnecessarily interfering with the railway company, but he might remark that he had received many communications from persons who stated that they had felt very much oppressed in their breathing while in the tunnels of the railway, and from others who had been advised by their medical attendants to give up travelling upon it. He had also received many letters suggesting modes of improving the ventilation in the tunnels, so that the jury would see the inquiry was very important, and absolutely necessary for the public interests. Everything that could be put before the jury in the shape of information ought to be adduced, both for the sake of the public and of the company. He proposed that the inquiry should be adjourned to Wednesday, the 30th of October. The jury acquiesced in the suggestion, and the inquiry accordingly stood adjourned.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Bulletin de l'Académie Royale de Belgique (Classe des Sciences).
June.

A. QUETELET, "Note on the Publication of the Meteorological Annals of the Royal Observatory at Brussels." A. QUETELET, "Extract from Chacornac's Letter on Sun Spots, and on the Disappearance of the Crater of Linnæus."

Monatsbericht der königlich-Preussischen Akademie.

April.

RIESS, "On Double Induction, and on the Theory of the Electrophorus." G. ROSE, "On the Meteorite which fell at Knyahinya, in Hungary, on June 9, 1866." J. PHILIPP, "On the Sulphocyanogen Compounds of Mercury." C. RAMMELSBURG, "On Phosphorous Acid and its Salts." E. REUSCH, "On the Effect of Pressure on Rock Salt and Calcite." H. HELMHOLTZ, "On N. Baxt's Experiments on the Velocity of Propagation of Irritation in the Motor Nerves of the Human Body."

Poggendorff's Annalen.

April 12.

H. BUFF, "On the Inductive Action of a Voltaic Current on the Mass of the Conductor." C. BOHN, "On Negative Fluorescence and Phosphorescence." E. VOIT, "On the Diffusion of Liquids." W. VON BEZOLD, "On Binocular Vision." A. SCHRAUF, "On the Deduction of the Form of Crystals from the Refractive Equivalents of the Elements of which the Crystal is composed." E. REUSCH, "An Experiment with Prince Rupert's Drops."

May 16.

A. TOPLER, "On the Construction and Performance of the Rotating Electrophorus." A. MITSCHERLICH, "On some new Methods of Determining the Constitution of Organic Compounds." W. BEETZ, "On the Influence of the Motion of the Origin of a Sound on its Pitch." G. JENZSCH, "On the Laws of the Formation of Twin Crystals of Quartz." A. BRIO, "On the Optical Properties of Hyposulphate of Baryta."

Annales der Chemie und Pharmacie.

Supplement. Vol. 5. No. 1.

C. ZWINGER, "On the Melilotic Acid, and on its Preparation from Coumarin." L. DARMSAEDTER, "On Potassio-Chloride and Ammonio-Chloride of Gold."

July 1867.

H. WICHELHAUS, "On the Constitution and Composition of Organic Acids containing three Atoms of Carbon." H. SCHRODER, "On Hypogaeic Acid." O. HAUSKNECHT, "On some Derivatives of Erucic Acid." C. WEINHOLD, "On Oxiphenylene Sulphurous Acid." H. KOLBE, "Remarks on the foregoing Paper." H. KOLBE, "On the Sulphuric and Sulphurous Ethers." R. WARLITZ, "On the Sulphurous Ether Isomeric with Ethylsulphuric Acid." R. OTTO AND L. BRUMMER, "On Sulphochlorobenzolic Acid, and on some Derivatives of the same."

Annales de Chimie et de Physique.

July.

A. CORNU, "Researches on Crystalline Reflection."

Journal des Fabricants de Papier.

June 15.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper-making: Starch."

July 1.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper-making. Continuation: Ultramarine. Antichlore. Prussiates of Potash."

Journal für Praktische Chemie.

June 8.

A. KENNGOTT, "On the Alkaline Reaction of some Minerals." A. KENNGOTT, "On Richmondite, Osmelite, and Neolite." A. KENNGOTT, "On Pyrophyllite, Hydrargillite, Pennine, Chlorite, and Clinocllore." L. R. VON FELENNBERG, "Analysis of a Green Mineral (Anorthite? Felspar?) from the Bernese Oberland." L. R. VON FELENNBERG, "Analysis of Serpentine from the Malenkertal in the Grisons." L. R. FELENNBERG, "Analysis of Calcite from Merlingen." T. BAIL, "On the Formation of Yeast." E. CARSTANJEN, "On Thallic Acid."

June 20.

B. WEISS, "On the Colouring Matter of Saffron." R. WAGNER, "On the Detection of Woollen Fibres in Silk Goods."

June 27.

R. HOFFMANN, "On the Causes of the Brittleness of the Bones of Horned Cattle." J. C. LEUCHS, "On the Bitter Principal of Hops, and on Deoxidation as a Means of Destroying the same." F. STOLBA, "An Analysis of some Ancient Bronze Objects, from the Collection in the Bohemian Museum at Prague." F. STOLBA, "On the Analysis of Bone Black." F. STOLBA, "On the Quantitative Estimation of Lead by Precipitation by Zinc." F. STOLBA, "On the Estimation of the Water of Crystallized Fluoride of Calcium Compounds." J. WOLF, "On the Constitution of some Aniline Colours."

NOTES AND QUERIES.

To Preserve Fresh Flowers.—Put a pinch of nitrate of soda into the water every day when you change it. This will preserve flowers for a fortnight. Nitrate of Potash in powder has nearly the same effect.—ISABEL DE W.

Detection of Sulphur in Petroleum.—"Refiner" will find the following plan, suggested I believe by Dr. Vohl, answer his purpose:—Digest the oil for some hours at a gentle heat with a small piece of sodium. Water being added, the aqueous solution is to be tested with nitro-prusside of sodium. The presence of sulphur is shown by the production of the well known purple colouration.—E.S.P.

Scarlet Ink.—Take garancin of best quality one ounce, digest with liquor ammonia one ounce, add one pint of cold distilled water triturate together in a mortar, filter, and dissolve in the solution half an ounce of gum arabic; or take pure carmine twenty grains, liquor ammonia three fluid ounces, dissolve, then add eighteen grains of powdered gum.—DR. A.

Succinic Acid.—The property of acetic acid to prevent the ordinary reaction of succinic acid alluded to by your correspondent, J. Hooper, in your last week's Notes and Queries column, is not new, although it does not seem to be generally known. More than forty years ago, two French chemists, named Lecann and Serbat, pointed out that the presence of acetic acid takes from succinic acid the power of forming precipitates with solutions of iron, copper, lead, and barium. Neither will a mixture of acetate and succinate of potash precipitate solutions of these metals.—ABEL SCOTT.

Development of Heat.—I was reading in a scientific work the other day, that air may be driven with so much force as to set solid substances on fire; and that ice may be dashed with such violence against another piece of ice that sparks of fire will be produced by the collision. Can any one tell me where the record of these experiments may be found, and who was the experimenter? I am aware that Sir H. Davy produced heat by rubbing two pieces of ice together, but I have never heard of fire being produced by the ice; perhaps some of your readers may enlighten me.—CRUCIS.

Sulphur in Petroleum.—It is not quite clear whether your correspondent wants a test for sulphur or any of its acids, since in refining petroleum sulphuric acid is used; however it seems at all events best to convert any sulphur compounds into sulphuric acid, and test for the latter. The oil may be decomposed by careful treatment with nitric acid, and afterwards the residue, after complete decomposition of the oil, diluted with water, and treated with nitrate of baryta to detect sulphuric acid. It must not be lost sight of that when sulphuric acid is used for refining, this will have to be removed entirely first, while one must also bear in mind that its use entails the possibility of engendering sulpho-oils not attacked by alkalis.—A.

TO CORRESPONDENTS.

W. E. Gill.—Received with thanks.

Wm. Johnson Sollas.—A letter addressed to Messrs. Bailey and Sons, Wolverhampton, will obtain for you the desired information.

Henri Du Chemin-Creux.—Your letter has been forwarded.

H. Dixon.—The subject is more suitable for our advertisement columns, than for our Notes and Queries.

H. Bowler, Philadelphia.—The journal shall be forwarded if possible.

J. D. M.—No fuller particulars have been published for obtaining oxygen from bleaching powder than appeared in the number of the CHEMICAL NEWS containing the announcement.

Ellora.—The new cement you refer to is not oxy-chloride of manganese, but oxy-chloride of magnesium. It was described by M. Sorel, before the French Academy a few months ago.

A. R. A.—Nearly all specimens of fluor spar are very phosphorescent. The native carbonates of lime are so in a less degree. M. Heinrich has published some very interesting experiments on this subject. He exposed the substances for about 10 seconds to the light of a clear day, but out of the direct rays of the sun to prevent their becoming heated; the observer was for 30 or 40 minutes previously in a perfectly dark chamber. The diamond and fluor spar shine for above an hour, but nothing else for more than a minute. When shining if a deep cut be made in the substance it will be seen to be as luminous at the bottom as at the surface.

Communications have been received from W. H. Smith (with enclosure); L. Power; W. E. Gill (with enclosure); J. Maculloc (with enclosure); H. Dixon; Henry Bower; Prof. H. How (with enclosure); W. Iglefield; W. Godwin (with enclosure); J. Watson; J. D. Muter; P. Sharp (with enclosure); S. W. Hinde; C. G. Williams F.R.S.; F. Cochrane; Dr. Odling F.R.S. (with enclosure); W. H. Harrison; A. Smart (with enclosure); J. Salter; T. Maguire (with enclosure); W. Tillson; H. Day (with enclosure); O. Schmidt; W. J. Sufolk; H. Monfitt; W. Johnson Sollas; Dr. Adriani; John Heywood; Alex. Parkes; J. Herschel; John Bray F.C.S.; E. P. Sandbury (with enclosure); E. Corbett (with enclosure); G. F. De Winton; E. Schenck (with enclosure); John Spencer; MacLachlan and Stewart; B. W. Gibbons; T. A. Readwin. P. Hart (with enclosure); S. Mellor.

Books Received.—"A Lecture on the Sewage difficulty, by Baldwin Latham. C.E."

THE CHEMICAL NEWS.

VOL. XVI., No. 411.

ON A

NEW APPARATUS FOR TECHNICAL ANALYSIS OF PETROLEUM AND KINDRED SUBSTANCES.

By S. F. PECKHAM.

IN the *CHEMICAL NEWS* for August 31st, 1866, I noticed a paper in which was described a process with apparatus, for the essay of coals and other substances yielding illuminating and paraffin oils.* After stating the fact, that no process had hitherto been described by which technical analyses of bituminous and pyro-bituminous substances could be made to yield analogous and satisfactory results, the author proceeds to describe what I should suppose to be a very valuable process for the primary distillation in the technical analysis of coals and shales. I do not repeat the description here, as it would require considerable space, and it can only be applied to the treatment of solid substances, which do not melt at a temperature below that required for their distillation. As the original paper is easy of access, I would recommend its perusal to all who wish to make technical analyses of either coals or shales. The apparatus is simple and inexpensive, and I am aware of no reason why the results furnished by it should not prove highly satisfactory, especially as its operation bears a striking resemblance to the most improved processes of manufacture on the large scale.

But beyond the primary distillation of the coal or shale, I do not consider that our author has added anything to processes long in use. When he arrives at the second distillation, or that which corresponds to the primary distillation of petroleum, he is forced to return to the old process of fractional distillation from a common tubulated glass retort. This process is not only very unsatisfactory in its results, but it is quite expensive, and is attended with considerable danger from fire. It is unsatisfactory, because the separation of fluids of different densities and different boiling points, is much less complete than by Warren's process, for any temperature below the boiling point of mercury; in fact, for any temperature necessary to ensure the complete separation of the light oils usually called naphtha, and the "photogen" or illuminating oil.† It is expensive, for the reason that if the distillation is conducted to dryness the retort is sacrificed, as it is rarely possible to remove the coke with safety. It is attended with danger from fire, because the best retorts are liable to fracture from the high heat to which they are exposed, even when the greatest care is exercised in conducting the operation.

I was about to commence a technical examination of several specimens of California petroleum, when the above mentioned paper arrested my attention, and I was unpleasantly conscious when I had finished its perusal that in respect to apparatus for this department of research my want was just as far from being supplied as it was six years since, when I commenced the study of petroleum. I had but a small quantity of each specimen, and besides subjecting them simply to fractional distillation, I wished to test them by Young's process of distillation, under pressure. To conduct the latter process in glass was an impossibility.

To answer my purpose therefore, my apparatus must fulfil the following conditions. It should be capable of working not more than one and one-half litres, and admit of being heated by an ordinary gas furnace. The joints should sustain a pressure of forty pounds per square inch, and it should be so constructed as to admit of the ready extraction of the coke. I could find no description of any such apparatus, but after numerous failures and corrections, in an apparatus of my own invention I found my want so well and fully supplied, that I am led to offer a description, for the benefit of those who, like myself, have felt the need of such an instrument.

Upon each extremity of a piece of a wrought iron gas-pipe, three inches in diameter and twenty inches in length, a cap is securely screwed. The caps should be heated nearly to redness and screwed on to the cold pipe in order that by their contraction they may be more firmly secured. The pipe is then put in a lathe and the caps turned off in such a manner as to leave a band upon each end of the pipe, about three-fourths of an inch in width, and two circular discs of iron, each about four inches in diameter, and one-fourth of an inch in thickness, having a projection upon one of their surfaces to which a wrench may be applied. The edges of each extremity of the pipe with the bands are now carefully turned off, presenting smooth surfaces slightly bevelled inwardly. The plane surface of each of the discs is then so turned off upon its circumference, that it will exactly fit the bevelled edge of the pipe. This completes the retort.

A stout parallelogram is then made half an inch longer and wider than the retort, one of the shorter sides of which should contain in the middle a stout set-screw, and the other an orifice made to fit the projection upon the disc. This may be called the frame.

Two holes are then drilled a short distance from either extremity of the retort, and in a line parallel to the axis of the retort. One of these should admit a half inch, and the other an inch gas-pipe. With this arrangement the retort may be used either for pressure distillation, or for distillation by the ordinary process. It also admits of being connected with an apparatus for furnishing superheated steam or carbonic acid gas, either of which are sometimes used to assist the distillation of hydrocarbons. Both the goose-neck and valve should be connected with the retort by a short piece of gas-pipe and a brass "union" or coupling, as the difference in the expansion of brass and iron would cause a joint of the two metals to leak very badly when subjected to a high temperature. The goose-neck may be made of the ordinary form, tapering from one inch to one-quarter inch, and about ten inches in length. The material should be copper, brazed. The valve will be described hereafter.

In order to use the retort, one of the discs is luted with a very thin paste of plaster of Paris and firmly pressed into its seat. The retort is then slipped into the frame and left a moment for the luting to set, the open end being uppermost. The oil is next poured in and the other disc luted into its seat, the frame adjusted and the set-screw firmly set up, so as to securely fasten both discs in their places. The goose-neck or valve is then adjusted, and the connections made with the worm and receiver. It will be observed that all the expansion that takes place in this retort only brings the different portions of the apparatus more firmly together, instead of causing them to crack apart and leak with every slight variation of temperature, as is usually the case. With this arrangement I was able to distil fifteen hundred cubic centimeters of petroleum to dryness, the last portions coming over at a red heat. The distillation was commenced with two ordinary Bunsen's gas lamps, increased as required to four, and towards the end of the operation to six—the latter number being sufficient to bring the side of the retort in contact with the flame to a bright cherry-red heat.

* On the Assay of Coal, &c., for Crude Paraffin Oil, and of Crude Oil and Petroleum for Spirit, Photogens Lubricating Oil and Paraffin, by John Atfield, Ph.D., F.C.S., Director of the Laboratory of the Pharmaceutical Society of Great Britain. *CHEM. NEWS*, vol. xiv. p. 98.

† For details of this process, see *Chem. News*, vol. xii., p. 85.

Any one who has attempted the distillation of small quantities of petroleum in either iron or copper stills, or retorts of whatever form, imbedded in coal fires or suspended over them, must be aware of the difficulty of so regulating the fire as to secure a constantly increasing heat from beginning to the end of the operation. No such difficulty is experienced with this apparatus. In it the lightest oils may be distilled by means of a sand-bath, and the heaviest by applying the flame of a sufficient number of lamps directly to the retort. The joints of this apparatus when luted with the smallest possible quantity of finely pulverized calcined sulphate of lime, admit of the least loss by leakage of any metallic retort that I have ever used. With the exercise of proper care the amount of distillate from California petroleum averaged above ninety per cent by measure, and with a pressure of thirty pounds per square inch the average was eighty-seven and one-half per cent. In the latter instance the loss was increased by the formation of gas and vapours that passed through the worm uncondensed at 8°C. The largest amount of distillate that I have seen recorded, as yielded by any material of undoubted natural origin, is ninety-five and one-half per cent, by measure.* The distillation of which this was the product was performed wholly in glass, without pressure, the crude material being a California petroleum of medium density, yielding no permanent gases and no naphtha. In this case the loss may be estimated at zero. I think it will be readily conceded, that any apparatus which admits of the ready extraction of the coke, and at the same time yields an average of ninety-two and one-half per cent of distillate, furnishes results far more satisfactory than any hitherto in use for operating upon so small a quantity as fifteen hundred cubic centimeters.

A thermometer may be inserted in the smaller orifice, for noting the temperature at which light oils distil. A piece of gas-pipe of the requisite size and about two inches in length may be used for making the connection, the thermometer being luted into one end of it. When but one of the openings in the retort is in use, the other may be closed with an iron plug.

In making my experiments upon Young's process of distillation under pressure, I experienced much difficulty in contriving an apparatus that would enable me to register the amount of pressure, and at the same time prevent any loss of vapour. I first attempted to register the pressure by means of a U tube, the arms of which were of unequal length. The tube was filled with mercury to a level with the shorter arm, and the long arm sealed with a column of air above the mercury. The pressure was indicated by the rise of mercury in the longer arm and consequent compression of the air, the shorter arm being in communication with the retort. The escape was badly regulated by an ordinary stop-cock. The very unequal expansion of glass and iron prevented me from making a tight joint between the retort and U tube.

I next tried a small valve constructed like an ordinary safety-valve. I found it impossible with this valve to prevent a large amount of loss from escape of vapour around the spindle.

I next tried a loaded valve, the load of which was placed directly upon the spindle, the whole contained in a chamber resembling a miniature steam-chest, from which the vapours could only escape into the worm. It was found upon trial with the safety-valve that an orifice three-eighths of an inch in diameter was too large in proportion to the size of the retort, the vapours escaping in too large volume to admit of a continued flow from the worm. The vapour escaped in intermittent puffs, thereby causing an undulatory movement from the requisite amount of pressure to no pressure at all. As a consequence, the results rendered were very imperfect. To obviate this difficulty, I made the orifice beneath the

valve only one-sixteenth of an inch in diameter, the surface of the orifice being to that of the retort as one to sixty thousand. This arrangement enabled me to secure a constant flow of vapour from the retort, to maintain a constant pressure, and to preserve a constant degree of temperature. I found by computation that a pressure of two ounces avoirdupois upon an orifice one-sixteenth of an inch in diameter was equivalent to a pressure of forty pounds to the square inch, yet when I placed a weight of two ounces upon the spindle, which of itself weighed half an ounce, the steam gauge registered only ten pounds, and the oils passed through it unchanged in density. Although I employed one of the most skillful workers of brass in this city to grind the valve, I am satisfied that the fault was in the mechanical execution of the work, and that the bearing of the valve was upon the side of the cone instead of at its apex, leaving a minute cavity beneath the valve. This fault could only be remedied by increased pressure. The chamber being too small to admit of placing the requisite weight upon the spindle, I made use of a spiral spring, the force of which was adjusted by an ordinary steam-gauge. By this means I was enabled to obtain the required pressure and to estimate its amount, with but one source of error, viz., the diminution in the elasticity of the spring incident to the high temperature of the vapours of the oil. I am convinced that the amount of this diminution is considerable; I have estimated it at one-fourth. The original elasticity returns, however, as soon as the spring is cold.

The following is a description of the valve as finally arranged. A piece of wrought iron gas-pipe one inch in diameter and three inches in length is bored out true, and an orifice drilled in its side one and one-fourth inches from the upper end, into which is brazed a piece of quarter inch gas-pipe about three inches in length. Both ends are now turned off and threads cut upon them, to which are carefully fitted strong brass caps. The upper cap should be about three-quarters of an inch in thickness, perforated two-thirds through from the inside with an eighth-inch drill, the orifice to serve as a guide to the upper end of the spindle. There should be a nipple three-fourths of an inch in length upon the lower cap, to connect it with the retort. The cap should be about one-half an inch in thickness, and with the nipple, should be perforated with a sixteenth inch drill. The seat of the valve should be excavated in the inside of the lower cap. A diaphragm should be placed within the iron tube, one inch from its lower end to serve as a guide for the spindle, through the centre of which the spindle should pass, while around it should be numerous small openings to allow for the free passage of the vapour. The valve itself should be turned upon the end of a spindle three-sixteenths of an inch in diameter, and carefully ground into its seat. The length of the spindle should be one-fourth of an inch less than the distance from the seat of the valve to the bottom of the orifice upon the inside of the upper cap, when both caps are in position. This allows the spindle to lift well, with sufficient room for the passage of the vapours. The diameter of the spindle should be reduced to one-eighth inch above the diaphragm. A spiral spring, of a diameter nearly equal to the interior of the pipe, made of brass wire about one-sixteenth of an inch in thickness, is so adjusted that the valve would be raised against the elastic force of the spring. This is effected by gradually reducing the diameter of the coils of the lower end of the spring to one-eighth inch, when it will just rest upon the shoulder upon the spindle. The upper coil of the spring should just touch the inside of the upper cap, when it is firmly screwed up. It will thus be seen that a force sufficient to cause the spring to contract one quarter of an inch is equal to a direct pressure upon the valve of two ounces. This depending for the same length of spring and size of wire upon the number of coils employed.

* Report of C. M. Warren, Esq., contained in an article on Petroleum in California, by Prof. B. Silliman, National Intelligencer, Feb. 17, 1866.

With this apparatus and the one described by Mr. Attfield, small quantities of every variety of bituminous and pyro-bituminous substances, may be subjected to treatment analogous to the most improved processes now in use upon the large scale. The results are reliable and admit of ready comparison. The cost of the retort with goose-neck add valve, made by the most skilful work-men, is about twenty-five dollars.

ON THE
PRODUCTION OF SOME NEW METALLIC
SULPHOCYANIDES,
AND THE SEPARATION OF CERTAIN BASES FROM EACH
OTHER BY THE METHOD THEREIN EMPLOYED.

By WILLIAM SKEY.

Analyst to the Geological Survey, New Zealand.

THE principle employed in the production of the following sulphocyanides is their great solubility in ether, by which not only can they be readily removed from their aqueous solution, but even their production in some instances determined.

Sulphocyanide of Cobalt.—If an alkaline sulphocyanide is added to an aqueous solution of a salt of cobalt, the colour thereof is merely browned, or, if ether is shook up with the cobalt salt, it remains colourless; but if ether is shook up with a mixture of the two salts, a blue colouration instantly results, which, on the subsidence of the water, is found to be confined to the ether. The ethereal solution left to evaporate spontaneously, affords beautiful slender crystals of a dark blue colour, containing sulphocyanogen and cobalt.

If alcohol is substituted for ether, the solution of the mixed salt is also coloured blue. The blue colour is destroyed by acetate of soda, chloride of mercury, and hyposulphite of soda.

Sulphocyanide of Uranium.—If ether is agitated with a solution of chloride of uranium, it remains colourless, but the addition of sulphocyanide of potassium thereto determines the uranium to the ether on further agitation, after first markedly increasing the colour of the uranium solution. On examination, the whole of the metal is found in the ether united with the sulphocyanogen. If iron is present, the ethereal solution will have a more or less red colour. In this case a deoxidizing agent is necessary to remove the iron, and thus manifest the colour proper to uranium.

Sulphocyanide of Molybdenum.—A solution of molybdic acid in hydrochloric acid is coloured a deep yellow by sulphocyanide of potassium, which colour is permanent in the air at common temperatures, while the addition of alcohol does not affect it; but instantly on contact with ether the colour rapidly darkens, and continues darkening till a deep red colour is attained. Also, if zinc is placed in a molybdic solution, to which a sulphocyanide has been added, together with excess of acid, the solution acquires a deep clear red colour, and ether removes a rich magenta coloured sulphocyanide of molybdenum, having a depth approaching to that of the iron compound with the same acid. Acetate of soda instantly discharges the colour.

Sulphocyanide of Tungsten.—This salt is best prepared by first treating a solution of tungstate of ammonia with the sulphocyanide. The granular precipitate thus produced is placed in contact with hydrochloric acid and ether. In a short time the ether acquires a yellow colour, and affords to the proper test good indication of both sulphocyanic acid and tungsten.

Sulphocyanide of Gold.—This sulphocyanide is very soluble in ether or alcohol, but scarcely dissolved by water. After taking great precaution to ensure the absence of iron, the colour of the ethereal solution was red.

Sulphocyanide of Copper is also soluble in ether if an excess of hydrosulphocyanic acid is present, communicating to it a dark brown colour. It can be completely removed from water by this solvent.

The metals of the following oxides or chlorides I have not been able to combine with sulphocyanogen to form compounds soluble in ether:—Oxides of manganese, sesquioxide of aluminium, sesquioxide of chromium, bichloride of platinum.

In respect to the iron compound with sulphocyanogen, its solubility in ether has been already pointed out in a former paper; but since then it has been ascertained that its affinity for ether is so great that it can be entirely removed from water by this solvent, and its presence revealed where the eye fails to detect it. And, further, that ether determines in a remarkable manner the instant and abundant formation of this coloured compound from protochloride of iron and sulphocyanide of potassium even in presence of a soluble hyposulphite—a circumstance in no ways wholly accounted for by the presence of ozone in the ether employed, since but the faintest indication of this body could be obtained.

Separation of certain Bases from each other by the method here employed.—It is I think highly probable that the principle of the abstraction of certain of the metals from water by ether in presence of hydrosulphocyanic acid might be advantageously adopted for the separation of the following metals.

1. Iron from the alkaline earths—alumina, sesquioxide of chromium, oxides of manganese, also from uranium, platinum, and nickel.

2. Cobalt from nickel.

3. Gold from platinum.

It should be mentioned that for the separation of iron it is necessary to have the solution somewhat dilute, and for reasons which will presently appear, the solution must not be very acid.

The separation of cobalt from nickel has just been satisfactorily accomplished upon this principle.

ON THE
CONSTITUTION AND PROPERTIES
OF THE

HÆMATITE IRONS OF WEST CUMBERLAND
By EDMUND G. TOSH, Ph.D.

THE composition of five specimens of Cumberland Hæmatite pig iron, as determined by chemical analysis, is given below.

	I.	II.	III.	IV.	V.
Iron ..	93.552	93.100	92.850	92.798	92.802
Graphite ..	3.082	2.952	2.997	1.902	1.879
Combined carbon }	1.265	1.235	1.134	2.186	1.892
Silicium ..	1.389	2.286	2.706	2.714	2.753
Sulphur ..	0.068	0.075	0.068	0.065	0.164
Phosphorus	0.027	0.055	0.028	0.030	0.055
Manganese	0.216	0.288	0.140	0.140	0.288
Titanium	0.006	0.006	0.007	0.007	0.005
Nitrogen ..	0.056	0.041	0.051	0.051	0.049
Arsenic ..	trace	trace	trace	trace	trace
	99.661	100.038	99.981	99.893	99.887

I. II. and III. are from Cleator, Harrington, and Workington respectively, and were all manufactured specially for conversion into the best varieties of Bessemer steel. In appearance they were much alike: the fracture presented a bold crystalline structure, due to the graphite disseminated through the mass in large scales. IV. is a pig iron likewise intended for the production of steel, but on account of its containing too little free carbon or graphite, could not be successfully employed. Like the first three

specimens, its fracture was highly graphitic, but in an inferior degree. V. is the analysis of ordinary grey forge iron made at Harrington.

Before examining the parts played by the various elements of pig iron in its conversion into steel, it is necessary to give a short outline of the Bessemer process.

Highly graphitic pig iron is melted and run into a large egg-shaped vessel of iron lined with some fire-resisting material, known technically as "the converter." In this vessel air is blown through the metal from beneath, the carbon and silicium are oxidised, and by their combustion produce a heat so intense, that in from 14 to 30 minutes, at the end of the process, the resulting almost pure iron at a dazzling white heat, may be poured out of the converting vessel in a stream almost as liquid as water. If steel be required, the necessary quantity of spiegeleisen (containing a known proportion of carbon) in a molten state, is added to the decarburized iron in the converter, previous to running the metal out into ingots.

If now, white, instead of grey iron be introduced into "the converter," and air blown through it, the heat does not increase, no carbon or silicium is burned. I have this upon authority of several influential steel-makers who have made practical experiments on the subject. This different bearing of white and grey iron is somewhat remarkable, as, up till the present time it has been the opinion of metallurgists, if there was a definite one on the point, that the internal arrangement of the various kinds of cast iron was very similar when in the molten state. The phenomena here presented would seem to point directly to the conclusion that the two varieties of iron, grey and white, retain in the molten state, at least to a certain extent, the constitution they possessed when solid. Karsten states that graphite in fused graphitic iron, may exist either in chemical combination or in mechanical solution. The different deportment of grey, as distinguished from white iron, inclines us to the latter opinion or an approximation to it, for besides simple solution of graphite in the mass of metal, we may admit the existence of a high carbide of iron, necessarily a much more unstable compound than that existing in white iron, and the carbon of which, being in a somewhat weak state of combination, may combine more readily with the oxygen of the air at a high temperature. Further, either the graphite or this high carbide of iron may be dissolved in a second lower carbide, nearly resembling white iron in composition. Of course any premises as to the state in which carbon occurs in iron must be in a great measure hypothetical, on account of the extremely limited and imperfect nature of our knowledge of the carbides of iron. One conclusion we may draw with perfect safety I think, that the carbon at a temperature not far above the melting point, is very differently distributed in grey and white iron respectively; and if in the latter, the 4 or 5 per cent of carbon is combined with about 95 per cent of the metal, we are justified I think in inferring that a portion of the carbon in grey iron exists in one of the conditions I have mentioned as probable.

I here give an extract verbatim from a paper read by Bessemer before the Mechanical Engineers, in which the various changes that take place during the conversion of pig iron into steel are very clearly and fully described. "The silicium always present in greater or less quantities in pig iron is first attacked, and unites readily with the oxygen of the air, producing silicic acid; at the same time a small portion of the iron undergoes oxidation, and hence a fluid silicate of iron is produced, a little carbon being simultaneously burnt off. The heat is thus gradually increased until nearly the whole of the silicium is oxidised, which generally takes place in about 12 minutes from the commencement of the process. The carbon of the pig iron now begins to unite more freely with the oxygen of the air, producing at first a small flame which rapidly increases, and in about three minutes from its appearance, a most intense combustion is going on; the metal rises higher and higher in the vessel,

sometimes occupying more than double its former space; and in this frothy fluid state it presents an enormous surface to the action of the air, which unites rapidly with the carbon contained in the crude iron, and produces a most intense combustion, the whole mass being in fact a perfect mixture of metal and fire. The carbon is now burnt off so rapidly as to produce a series of harmless explosions, throwing out the fluid slag in great quantities, while the combustion of the gases is so perfect that a voluminous white flame rushes from the mouth of the vessel, illuminating the whole of the building, and indicating to the practised eye the precise condition of the metal inside. The blowing may thus be left off whenever the number of minutes from the commencement, and the appearance of the flame, indicate the required quality of the metal. This is the mode preferred in working the process in Sweden, but at the works in Sheffield it is preferred to continue blowing the metal beyond this stage, until the flame suddenly drops, which it does on the approach of the metal to the condition of malleable iron; a small measured quantity of charcoal pig iron, containing a known proportion of carbon is then added, and thus steel is produced of any degree of carburisation, the process having occupied about 23 minutes from the commencement. The converting vessel is tipped forward, and the blast shut off for adding this small charge of pig iron, after which the blast is turned on again for a few seconds."

"In the new process the carbon and silicium of the iron itself were employed as fuel to support the heat for reducing the cast iron, and the intense heat thus obtained, together with the intimate mixing of the air blown through the metal in a fluid state, caused the reduction to be much more rapid. Instead of the silicium in the iron requiring 2 or 3 hours to be burnt out as in the ordinary puddling process, it was now burnt out in only 12 minutes, giving out a great amount of heat by its combustion: and the complete reduction of the metal occupied less than half an hour, and was accomplished with far greater certainty and completeness, while 3 to 4 tons were acted upon at once instead of as many hundred-weights."

From this it would appear that silicium is first oxidised in the process of conversion, and that its combustion produces a great elevation of temperature. If this be correct, returning to the way white iron behaves in the converting vessel, it seems that not only the carbon, but the silicium too, is differently situated in white and grey pig iron in a state of fusion. An explanation of these various conditions and phenomena must at present be a matter of pure conjecture, as we are almost without information on this very important point. When the combustion of the graphitic carbon commences, the heat rises rapidly, chemical affinity between the iron and its constituents is so to speak weakened, the oxygen of the air is at liberty to act with greater effect, the carbon which existed in the crude iron in the combined condition is burnt, the last portions of silicium are oxidised, and good malleable iron results. If in the use of white iron a temperature could once be obtained high enough to lessen to such an extent the affinity between the metal and its carbon, as to allow the oxygen to take the latter, the conversion would succeed, but unless this elevated temperature could be imparted to it previous to its treatment with air in the converting vessel, its peculiar constitution renders this otherwise impossible. Lately in Styria and, I believe, in certain parts of England, by a lengthened treatment in "the converter" with highly pressed air, pig irons resembling IV. (in the table) in composition, containing a small quantity of graphite, have been manufactured into an inferior kind of steel.

Chemists are generally of the opinion that the quality of Bessemer steel is strongly influenced by the amount of silicium contained in the raw iron from which it was derived, and Phipson† sought to prove that in pig irons

which may be successfully used in the making of steel, the silicium must, like the carbon, exist in the free state. The means by which he arrived at this conclusion were somewhat peculiar, and I was induced to make some experiments on the subject, an account of which I published. Phipson† had examined three varieties of iron, A, B and C, in which he found the silicium to exist as under:—

	A	B	C
Combined silicium or Sia	98	1'81	2'60
Graphitoidal silicium or Siβ	3'22	2'15	1'63
	4'20	3'96	4'23

Because A contained its silicium principally in the free state, and C for the most part combined, they yielded respectively good and bad steels. In order to detect this graphitoidal silicium, I dissolved about 20 grammes of iron I. (in the table of analyses, which ranks highest among steel makers), in dilute hydrochloric acid, collected the insoluble matter, and burned it in oxygen. The residue was evaporated to dryness twice with hydrofluoric acid to remove silica, and afterwards heated with strong hydrochloric acid to remove a small quantity of oxide of iron. After this treatment I obtained a very small quantity of a light brown substance which displayed none of the physical properties of graphitoidal silicium under the microscope, but which proved to be titanitic acid. Had free silicium been present I should have detected it.

To estimate the two modifications of silicium, Dr. Phipson treated a weighed quantity of the iron with aqua regia, the resulting silica from Sia was dissolved by the acid, while that from Siβ was insoluble. It is a well established scientific fact, that any variety of silicium which has once been exposed to a red heat (as Siβ in iron must certainly have been) is quite unaffected by aqua regia—enough in itself to show how little this process is to be relied on.

To see if the amount of insoluble silica was a constant quantity I made the following three experiments.

I. 2'409 grms. of iron dissolved in aqua regia (3HCl+NO₆H) gave 0'0565 gm. SiO₂=1'094 per cent silicium.

II. 2'39575 grms. of iron in a large excess of aqua regia gave 0'038 gm. SiO₂=0'74 per cent silicium.

III. 2'336 grms. of iron, dissolved in aqua regia, and most of the acid carefully boiled off before filtering, gave, 0'06775 gm. SiO₂=1'353 per cent silicium.

As might be expected, the amount of insoluble silica varies with the quantity of acid employed; thus in II., where much acid was used, the quantity of silica is only about 1/3 of that in III., where, previous to filtration, most of the acid was boiled off.

In what I took as a reply to my communication of these experiments, Dr. Phipson† stated that what he at first looked upon as free silicium in pig iron, occurred, he had more recently found, as silicic acid combined with protoxide of iron. Now if we are to consider the 3'22 of Siβ (given in Dr. Phipson's estimations), as present in the state of silicic acid saturated with protoxide of iron, we arrive at the astounding discovery that this iron contains 23'46 per cent of slag. Few chemists would accept this statement without strong evidences of its truth. To ascertain whether this position were tenable, I heated 3 to 4 grammes of Cleator iron (I.) in a stream of perfectly dry chlorine; all iron and silicium are volatilised as chlorides, while silica, if present, remains unaffected. The carbon burnt off in oxygen. I obtained a small residue, mostly titanitic acid, weighing only 1 or 2 milligrammes, equal to 0'3 per cent, instead of 6 or 7 per cent, as Dr. Phipson would show.

From his experiments, by a course of reasoning upon which we have no enlightenment. Dr. P. infers that only

Sia, and not Siβ, exerts a deleterious action in the conversion of iron into steel. If, however, we have shown his assumption that Siβ exists in pig iron is groundless, no correct conclusions can be drawn from the data which he has given, and until our information is more definite, the subject must remain where it is.

The presence of graphitoidal silicium in iron, though believed possible by many metallurgists, has, as far as I know, never been clearly shown. Percy† thinks its existence highly probable, and Bichner ‡ makes a statement to the same effect, but neither seem to have made any special experiments on the subject. Hahn § prepared a silicide of iron containing as much as 20'29 per cent silicium. By treatment of this substance with hydrofluoric acid, a small crystalline residue remained undissolved, which proved to be a definite compound FeSi₂. Even with this enormous percentage of silicium none of that element separated in the free state. In the preparation of this compound only pure materials of known composition were used, and it may be urged that in the presence of the numerous substances which make up the constitution of crude iron, its behaviour might be modified. Caron|| a high authority in these matters, distinctly states that silicium never can exist in the uncombined state in iron, and that on account of its superior affinity it expels most other elements from combination.

Although altogether disagreeing with Dr. Phipson's conclusions, or more exactly with the way in which he arrives at them, I believe it quite possible that silicium may exist variously combined in pig iron, and as it occurs in one manner or another (as yet undefined) may exert a more or less deleterious action upon the steel made from it. I look upon it nevertheless, as a fact, that an iron tolerably rich in silicium, may be converted into good steel, although it contains neither graphitoidal silicium nor silicate of protoxide of iron.

(To be continued.)

A PRELIMINARY NOTICE OF THE AKAZGA ORDEAL OF WEST AFRICA,

AND OF ITS ACTIVE PRINCIPLE.

By THOMAS R. FRASER, M.D.

THIS ordeal poison is referred to in the works of Du Chaillu* and Winwood Reade;† and several of its toxic properties have been described by MM. Pecholier et Saint-pierre.‡ A few specimens were sent to this country in 1864 by the Rev. A. Bushnell of Baraka, and these were very kindly given to the author by Mr. Thomson of Glasgow; and a further supply came from the same quarter in 1865. These gentlemen, and Dr. Nassau of Bonita, supplied valuable and interesting information regarding its employment.

The poison is known in Africa as Akazga, Boundon (or M'Boundou), Ikaja, and Quai; Akazga being probably derived from *nkazga*, which signifies pain or hurt. It is used as an ordeal for the detection of real and superstitious crimes on the West Coast of Africa, in a large district which extends north and south of the equator, and many miles inland, and also in the adjacent island of Corsica. It is believed that several thousand persons are annually subjected to this method of trial, and that the fatal cases are about 50 per cent.

The Akazga arrived in bundles, which consisted of long, slender, and crooked stems, having their roots generally attached to them, but sometimes their leaf-bearing

+ "Metall. Iron and Steel."

† *Journ. f. prakt. Chemie*, bd. 72, p. 364.

‡ *Ann. d. Chem. u. Pharm.*, cxxix. p. 57.

§ "Memoire sur les Aciers."

* Explorations and Adventures in Equatorial Africa 1861.

† *Savage Africa*, 1862.

‡ *Comptes Rendus*, 1866, p. 809.

branches only, and containing also a very few complete plants, with roots, stem, and branches. The plant is usually about six feet in length; but some specimens were only four, and others as long as eight feet. The bark is yellowish orange, and in some parts light red, and it is frequently covered with a gray efflorescence. It adheres firmly to the stem, but may be readily detached, after exposure to a gentle heat for some days. Its internal surface is light brown. The space between the bark and the wood was found, in a few pieces, to be occupied by a large number of minute sparkling crystals; but it has not yet been determined whether these consist of a vegetable or mineral substance. The leaves are opposite and oval- acuminate in form; the apex frequently consisting of a linear prolongation more than an inch in length. From its general characters, the plant is supposed to belong to the Loganiaceæ, but the materials are insufficient to identify it.

By boiling the powdered bark with alcohol of 85 per cent, and distilling and evaporating the tincture, a brown shining extract is procured, weighing from 12 to 15 per cent of the bark employed. It has a bitter, non-persistent taste, and, when treated with concentrated nitric acid, produces a brownish-yellow colour, which is not materially affected by heat, nor by solution of proto-chloride of tin. It is obvious that the active principle of Akazgia is contained in this extract; and to separate it the following method has been adopted, after several attempts with various processes:—The extract is treated with a very dilute solution of tartaric acid, which removes 77 per cent, and filtered. The clear, yellowish-brown acid solution is shaken with successive portions of ether, so long as any colour is removed; and by this means also a small quantity of an aromatic oil is separated from it. After decantation, a solution of carbonate of sodium is added to the liquor, so long as it causes a nearly colourless, flocculent precipitate. It is again shaken with ether, which is decanted, and agitated with three successive portions of distilled water, and finally received in a bottle containing a dilute solution of tartaric acid, and shaken with it. As soon as the ethereal solution is brought in contact with the acid, it becomes opalescent, but again assumes its normal appearance on agitation. This change is of some value, as indicating the frequency with which the alkaline solution should be treated with ether, as the milkiness, on contact with tartaric acid, is not produced when the former is exhausted. On reaching this stage the tartaric solution is exposed to a gentle heat—to free it completely from ether—filtered, and again treated with carbonate of sodium, by means of which a bulky, colourless, and flocculent precipitate is obtained. This is collected in a filter, washed, and dried, by exposure to a gentle heat for a short time, and then by the action of sulphuric acid *in vacuo*.

By this means a colourless, amorphous substance is obtained, which is the active principle of the Akazgia poison, and which possesses the general properties of a vegetable alkaloid. About 10 grains may be separated from 500 grains of the powdered stem-bark, or 2 per cent. Akazgia is proposed as its name; and it is hoped that when the plant is described, if it has been previously unknown to science, Akazgia will be adopted as its specific name, and thus the usual connection of nomenclature between the vegetable alkaloid and its source will be maintained.

Akazgia is soluble in about 60 parts of cold absolute alcohol; in about 16 parts of spirit, of 85 per cent; in about 120 parts of anhydrous sulphuric ether; and in 13,000 parts of distilled water, at a temperature of 60° F. It is freely soluble in chloroform, in bisulphide of carbon, in benzole, and in sulphuric ether of specific gravity 0.735. It crystallises with difficulty, but it may be obtained in the form of minute prisms, by the slow evaporation of a solution in rectified spirit. An analysis of its platinum-salt, and a determination of its combining proportion with dry hydrochloric acid, yielded 290 in the former, and 293 in the latter, as the equivalent of Akazgia. When heated it

becomes yellow, then melts, and gives off fumes of a pungent, disagreeable odour, and finally becomes charred, but leaves almost no residue if the heat be continued for a sufficient time. Its solutions have an alkaline reaction, and neutralise acids; and the salts are freely soluble in water, and have a very bitter, non-persistent taste. Concentrated nitric, hydrochloric, and sulphuric acids change its colour to brown, but these in a diluted state, as well as many of the organic acids, form pale, yellowish solutions with Akazgia. It is precipitated from these solutions by hydrate, carbonate, and bicarbonate of sodium, and of potassium; by iodide, sulphocyanate, ferrocyanide, and chromate of potassium; by phosphate of sodium, protochloride of tin, trichloride of gold, dichloride of platinum, potassio-mercuric-iodide, carbazotic acid, tincture of galls, solution of iodine, and various other substances, but these precipitates are never crystalline. Corrosive sublimate causes an amorphous white precipitate, which is dissolved by heat, and reappears in a non-crystalline form when the solution has cooled. Chlorine produces an amorphous, colourless precipitate, which does not disappear on the addition of ammonia. With concentrated sulphuric acid, and peroxide of manganese, bichromate of potassium, or any other of the usual oxidising agents, the same succession of colours is produced, from blue to brown, which results from a similar treatment of strychnia.

The alcoholic extract of Akazgia possesses physiological properties very similar to those of nuxvomica; and comparative experiments were detailed, to show that the active principle, Akazgia, has exactly the same actions as the extract, and a proportional activity to it.

There are several instances in which a Natural Order produces several very similar active principles. In the Loganiaceæ itself, strychnia, brucia, and igasuria already exist, and these are nearly identical in their physiological actions. In chemical properties, brucia and igasuria have much in common, and they are both readily distinguishable, in this respect, from strychnia. Akazgia conveniently completes this group, as its chemical properties are nearly allied to those of strychnia, whilst its connection with all the members is maintained by the similarity of its physiological actions.—*Proceedings of the Royal Society of Edinburgh, Session 1866-67.*

BRITISH PHARMACEUTICAL CONFERENCE.

FOURTH ANNUAL MEETING, AT DUNDEE.

President—PROFESSOR BENTLEY, F.L.S., M.R.C.S., &c.

(Continued from page 192.)

"On Granular Charcoal."

By WENTWORTH LASCELLES SCOTT, F.C.S., &c.

For some years past the value of charcoal, for internal use, has been gradually more and more recognised, and probably it would have been employed to a still greater extent, but for some little difficulties in the way of its convenient administration.

I may truthfully claim the originality and priority as regards granular charcoal, as it is now many years since my first experiments were made with this preparation, with the kind assistance of my friend the late Mr. Frank B. Fowler.

Granular charcoal has the several advantages of being a definite preparation, easy of administration, and not liable to alter by keeping.

I prefer to use box, willow, or lime-tree wood for conversion into charcoals for medical purposes, merely on account of their texture and absorptive powers; and the

carbonised matters, when free from all volatile substances, should be cooled out of contact with air, and boiled for some time in a dilute solution of hydrochloric acid, followed, after copious washings with pure distilled water, by a little weak ammonia.

The dried fragments of charcoal thus purified are then ready for a second ignition, which may be effected in tubes, cylinders, or retorts of metal or porcelain; after which, and before they are cold, they must be quickly pulverised and passed through a sieve of from 80 to 100 apertures to the inch.

Nine pounds of this finely-divided carbon may then be intimately mixed with one pound of pure sugar (which has been passed through a No. 30 sieve), and about four ounces of arabic or gum acacia in the state of impalpable powder. The whole should next be slightly moistened, by means of an Atkinson's diffuser, or other similar instrument, with a few ounces of warm distilled water, to which has been added about 1½ ounces of tincture of benzoin, and a little mucilage; it is then ready for granulation, which is effected upon a flat steam-pan in the usual manner, at a temperature of 215° to 225°; a little extra care and attention should be given to the manipulation in granulating charcoal, as compared with other preparations; an additional rolling kind of action being required, which is readily learnt after a few trials.

The charcoal should be sifted when perfectly dry, and while yet warm, and secured in well-stopped bottles or jars. I would recommend sieves of Nos. 6 and 16 gauze respectively.

Granular charcoal, when properly made, should possess a hard compact structure, and a sweet and slightly aromatic taste; it should not soil the fingers when dry, but must disintegrate very quickly without exhibiting any gritty particles in the presence of moisture; further, its integral porosity is by no means destroyed, as good granular charcoal may absorb fully eight and a half times its volume of sulphuretted hydrogen at ordinary temperatures, and proportionate quantities of other gases.

It is to this very property of the absorption or liquefaction of gases by charcoal, that I wish to draw your attention for a few moments. We all know that upon this alone, or very nearly so, depends the value of charcoal as a disinfectant and as an oxidiser, in whatever way it be employed, and we are very generally acquainted with the fact, that its power of taking up many of the easily liquefied or more soluble gases is very great indeed. As an instance, take ammoniacal gas; in the generality of scientific manuals and text-books some notice is taken of this, but in very loose terms, the amount of absorption being variously given up to "about ninety times the volume" of the charcoal itself, while my own experiments show that charcoal is capable of absorbing no less than 122 volumes of ammonia.

Now, putting aside certain collateral points for the moment, we may state generally that charcoal is taken internally, for the purpose of absorbing and masking the action of any acidulous and soluble gases that may be present in excess, thereby preventing or greatly diminishing their injurious action. Granting its usefulness in this respect, the question immediately arises, why not sometimes reverse the proposition? Why should not charcoal be made the carrier of gaseous bodies suited for the treatment of certain forms of disease, but which, under all ordinary methods, are either impossible or very difficult to administer?

My late experiments have been directed towards this question, and I am decidedly of opinion that charcoal, saturated with various gases, may hereafter become useful remedial agents. The subject is naturally one which cannot be treated lightly, and which requires some extended and patient labour for its proper development; but as far as I have already gone, the results are, in my opinion, most encouraging.

"Analysis of Ordinary Commercial Specimens of Jalap, showing their relative Value in proportion of Resin of Jalap compared with market price."

By MR. ALFRED SOUTHALL, Birmingham.

No. 1	Description.	Resin.	Market Price.
1	Jalap tops .. 5 per cent	..	4d. per lb.
2	" " " 12	"	5d. "
3	" " Tampico 9½	"	10d. "
4	" " " 10½	"	1s. 0d. "
5	" " " 30½	"	1s. 0d. "
6	" " " 29	"	1s. 6d. "
7	" " " 12½	"	1s. 6d. "
8	" " " 33½	"	2s. 0d. "
9	" " " 27	"	2s. 0d. "
10	" " Vera Cruz 15½	"	4s. 0d. "
11	" " " 17½	"	4s. 0d. "
12	" " " 17½	"	4s. 0d. "
13	" " " 12½	"	4s. 0d. "
14	" " " 23	"	4s. 4d. "
15	" " " 20½	"	4s. 6d. "
16	" " " 16½	"	4s. 10d. "

In order to ascertain the medicinal value of the supplies of jalap, as found in the shops of pharmacutists, I procured five specimens of powdered jalap at different establishments, and found the result, in per centage of resin, as follows:—

No. 1,	13 per cent of resin.
" 2, 15	" "
" 3, 9½	" "
" 4, 16½	" "
" 5, 17	" "

The commercial value of jalap imported from Tampico is much inferior to the kind imported by way of Vera Cruz, but an average of seven samples of each kind here analysed, show that the Tampico is richer in resin than the Vera Cruz; the average in the one case being about 22 per cent, and in the other 17½ per cent.

I have made an experiment with the purgative effects of the two varieties, and find them much the same. The resin from Tampico jalap is somewhat darker than that from the Vera Cruz variety, and has a distinctive peculiarity of smell, but I have not discovered any difference in chemical character.

REPORTS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, October 1st, 1867.

EDWARD SCHUNCK, Ph.D., F.R.S., &c., President, in the chair

DR. CROMPTON, alluding to the paper he read in October, 1866, "On the Portraits of Sir Isaac Newton," said, that while preparing his essay for publication in the Memoirs of the Society, he had opened up fresh sources of information, and become possessed of facts of considerable interest respecting the portraits of Newton. He had examined about twenty portraits of the great philosopher, all of which were considered to be originals, and most of which were undoubtedly painted a long time ago; but he had seen no portrait which, in his opinion, was of equal importance and interest with the Kneller Newton of 1689, to which he last year directed the attention of the Society, as by far the most valuable portrait of the great philosopher in existence, and of which he exhibited an admirable engraving by Mr. Oldham Barlow. His extended inquiries into the subject of the portraits of Newton had led him to the conclusion that there are several (if not many) which pass current as portraits of him which are most decidedly

representations of other persons. In the National Portrait Exhibition at Kensington of the present year there were four portraits of Newton, two of which he feels sure have no real claim to be regarded as authentic or genuine. These two are pictures contributed by the Earl of Dartrey and by the Marquis of Exeter. The former purports to be a portrait of Newton when he was a Bachelor of Arts, and to be painted by Lely. It represents a young man with his hand resting on a globe; and there is an engraving of the picture, done many years back, but he had no hesitation in saying that the picture had no right to be considered a portrait of Newton. The features were not Newton's, and it was most improbable that the poor Trinity College Sizar would, when a Bachelor of Arts (that is, between January, 1665, and July 7, 1668) have cared, or, if he had cared, could have had the means to obtain a portrait of himself. He apprehended that because the portrait represented a young man with his hand on a globe, some imaginative person had supposed that it must be a representation of the great philosopher who had explained the system of the universe. But this portrait represents one of the poorest specimens of humanity; and certainly not a Newton, but rather a Simple Simon. The Marquis of Exeter's picture has hardly any greater claim to be regarded as a Newton. It represents a man with a bald head, but we have the clearest evidence that Newton was not bald.* The two Vanderbank portraits, representing him the year before his death without his wig, show that he had a beautiful head of silver white hair. There is another portrait of Newton by Thornhill, taken at an earlier period, which represents him without his wig, but with short white hair and no trace of baldness. The Portsmouth Kneller of 1689, which represents him when he was 47 years old, shows him without a wig and with abundant grey hair. This is a sufficient ground for rejecting this picture; but no one who has studied the portraits of Newton could be brought to believe that this is a representation of the great philosopher. Last year when reading his paper, Dr. Crompton remarked that he had been unable to discover where the original Kneller of Newton, engraved by Houbraken, was to be found. He then pointed out that in some impressions of the Houbraken print it was stated to be in the possession of Mr. Conduit. Dr. Crompton went to the Earl of Portsmouth's seat at Hurstbourne Park, and there found the original picture. It is dated 1702 and signed by Kneller. The Earl of Portsmouth, Newton's collateral descendant, therefore possesses the two most important portraits of Newton. This portrait of Newton was engraved also by Smith, about 1712. A replica, if not an earlier copy, without any name of an artist upon it, is in possession of the Duke of Devonshire at Holker. His Grace informs me that he cannot positively trace its coming into the possession of his family, but he conjectures that it may have been at Holker before the marriage of one of the Lowthers with Lady Mary Cavendish, through whom this Holker property passed to the Cavendishes. There is an exact replica or early copy of the Portsmouth Kneller of 1689 at Lord Galway's, except in not having the name of Newton or of Kneller upon it, which Dr. Crompton has examined, and which, in an old catalogue of the pictures, is said to be painted by Bond. Dr. Crompton said that he had examined the three oil paintings of Newton in the Royal Society's collection; also the Kneller at Hampton Court, which is dated 1689, and differs from the Portsmouth Kneller of 1689 only in the position of the hands; also all the portraits of Newton belonging to Trinity College, Cambridge; the Indian ink drawing of Newton in the Pepsian library at Magdalen College; and a portrait at Mrs. Miles', at Firbeck Hall, Yorkshire, which resembles very much the Egremont Newton by Kneller, engraved as a frontispiece

to Sir David Brewster's first life of Newton, published in the Family Library. Dr. Crompton exhibited this edition of Brewster's life, as well as the larger one in two vols. In the text of both the engravings, which differ very greatly from each other, are said to be from a picture in the possession of Lord Egremont. Sir David Brewster is unable to explain how it is that two engravings from distinct and different portraits should thus happen to be spoken of in the text, except that his publisher must have selected the second portrait and got it engraved. It is, I think, unmistakably taken from Smith's print of 1712 or an early impression of Houbraken's engraving. The portrait prefixed to the small Life of Newton is the same as that engraved in Lodge's portraits. At present Dr. Crompton is unacquainted with the historical evidence regarding the genuineness of this portrait. It is signed by Kneller and dated 1716; but Dr. Crompton has not yet seen it, nor one in the possession of Mr. Turner, of Stoke Ashford, near Grantham.

In Lord Portsmouth's collection at Hurstbourne, besides three genuine and authentic portraits of Newton, there is a fourth picture with the name of Newton painted upon it. It was described to Dr. Crompton by a gentleman who had had an opportunity of a very close examination of it, as the earliest and most important portrait of the great philosopher. But Dr. Crompton found neither date nor artist's name upon it, and the picture, which is mounted upon panel, has a crest in red wax behind it, which is not the crest of the Portsmouth family, but could not be sufficiently determined what it was for want of a magnifying glass. The history of this picture will be investigated further; though it is certain that it cannot be a portrait of Newton, for the features are not his, and the eyes are brown, while Newton's were bluish grey. It is most earnestly to be desired that all the portraits of Newton might be collected together at Kensington next year for comparison with each other, and that the portraits of other great men (where there are several) should be thus exhibited in juxtaposition. It would probably then be evident that there exist many spurious ones, and an opportunity would be thus afforded of determining which are the best as well as the true.

Mr. R. D. DARBISHIRE, F.G.S., referred to a paper "On the Existence of a Seabeach on the Limestone Moors near Buxton." (*Trans. Manchester Geol. Soc.*, v. p. 273), in which Mr. John Plant, F.G.S., had described as sea beach the surface of the limestone rock as the same is seen when bared of sward and surface clay above the quarries on Grin Edge and Harper Hill, south-west of Buxton, and to Mr. Plant's conjecture that this worn surface probably extended nearly to the crown of the hills.

His own observation had marked on each hill, above the stratum whose upper surface exhibited those indications of wear, a stratum of somewhat different texture still subsisting in the shape of a slight vertical cliff or reef. This bed had not worn in the same manner as the "beach," that is to say, with many interlacing fissures having a close *chevaux de frize* of limestone points, but rather in great blocks with round, curved edges or holes.

In connection with this bed, Mr. Darbishire had obtained specimens from each hill exhibiting what he believed to be the remains of the burrows of *Pholas* shells.

On the top level of Grin Edge, close to the ruins of the tower, one stone had a group of seven holes. They were placed like *Pholas* holes as he had collected them on Great Orme's Head; and, though the surface of the stone about them was much worn, taken along with the specimen next described, it seemed more fitting to ascribe to them a similar origin than to attribute them to the natural wear of the stone, notwithstanding the variety and singularity of many of the forms in which atmospheric or aqueous corrosion affect the limestone rock.

This stone lay amongst a heap of others near the ruins of the tower, and had doubtless been brought up a few feet. The height above the sea of the tower is stated on the Ordnance Map as 1,435 feet.

* Mr. Conduit, Newton's nephew by marriage, when describing Newton's personal appearance, says, "With a fine head of hair as white as silver, without any baldness, and when his peruke was off, was a venerable sight."—Brewster's *Life of Newton*, 1855, vol. ii., p. 413.

On Harper Hill, in two large blocks of the overlying stratum, he had detected more characteristic holes. Both blocks were lying in the sward above the "beach" surface, and were a few feet below the rock *in situ*, from which they had evidently been detached. Of the first of these specimens he exhibited a photograph. It showed in the under side of the edge of a projecting ledge or table of stone six well marked holes from $\frac{3}{4}$ in. to 1 in. in diameter, and one an inch deep, and traces of two others. The holes were grouped just as Pholas holes usually are, and apparently were quite independent of the structural fissures of the stone.

According to measurement with an aneroid barometer, the stone in which those holes occurred was about 1,380, and the reef from which it had fallen about 1,400 feet in elevation.

If the holes were really Pholas burrows, they would indicate the elevation of these hills since the period of glacial action by sea or land.

Mr. BINNEY, F.R.S., F.G.S., remarked on the great elevation of these remains if the observations were accurate, and observed that they were on the west side of the hills. Mr. Prestwich had discovered shells in shingle on the western slopes of the Axe-edge hills towards Macclesfield, at the height of 1,150 feet. He would like to hear of observations on the eastern side of the Derbyshire hills if any traces of marine action were to be discovered there.

Mr. DARBISHIRE had not the specimens at hand, but would produce them, in connection with a series of similar remains from Orme's Head, to which he proposed to call the attention of the Society at an early meeting.

ACADEMY OF SCIENCES.

OCTOBER 14, 1867.

(FROM OUR OWN CORRESPONDENT.)

Lever Barometer—New Mountain Barometer—Solar and Lunar Halos and Coronæ—The Pascal-Newton Forgeries—Solar Spots—Water Conduits.

THE discussion between M. Radau and the Rev. Father Secchi on the lever barometer is not yet terminated. At the last meeting, M. Secchi tried to prove that the barometer did not require any thermometric corrections. M. Radau now affirms that Father Secchi, in his demonstration, has confounded the dilations produced by 10° with those produced by 1°C ; the consequence is that the calculated numbers are false. In reality the error of the barometer is more than a millimètre for 10° , instead of being the hundredth part of a millimètre, as M. Secchi affirms.

M. F. de Bruno, Professor at the University of Turin, presented a barometer formed of two or three concentric tubes of glass or cast iron—a sort of lever barometer which possesses the considerable advantage of being able to be transported without great danger of rupture, or the loss of the vacuum. His idea is simple and ingenious.

M. A. Decharme, Professor at the Imperial Lyceum of Angers, observes with much care the great and small solar and lunar halos and coronæ; he has ascertained that—1st, At Angers these meteoric phenomena are more frequent than is generally believed. From the 30th August, 1866, to 30th August, 1867, he had observed 33. 2nd. In all cases they were followed by rain or snow on the same day, the day following, or, at latest, on the next day for a very small number. 3rd. That in general the rain is the nearer and more abundant in proportion to the brilliancy of the phenomenon. The study of halos can thus furnish precious indications as prognostics of the weather.

M. Faugère writes to the Academy a letter truly incredible; also a comparison of Pascal's notes with the only page of the illustrious philosopher which was at his disposition, and has very roughly concluded the falsity of

all the documents of M. Chasles. At present the comparison of a letter of King James, kindly placed in his hands by M. Chasles, with the fac-simile of a similar letter found by him in a printed work, he declares apocryphal to the letters of M. Chasles. He does not even remark, as M. Morin observes, that often the letters of sovereigns are neither written nor signed by them, and that they are not the less authentic documents. He asks simply that all the autographs of M. Chasles be submitted to an enquiry confided to the direction of the Imperial Printing Establishment, and to the most learned connoisseurs of its administration. M. Chasles declares formally that he denies the competence of M. Taschereau, whose ability in discernment of autographs appears to him to be doubtful; that he is disposed to publish the entire collection of these documents. Meanwhile he places them at the disposition of all those who wish to consult them, but that they shall not leave his possession. He remarked that this enquiry has been already made, for several of the most important pieces with those of the British Museum, the Royal Society of London, by many amateurs, by the aid of a fac-simile taken from the most authentic autographs, and the comparisons have successfully overruled all the objections put forward. M. Chasles reverted also to the origin of his autographs; he thinks that he can satisfy to all purposes the indiscreet questions that have been put to him in affirming that they formed part of the collection of Desmaizeau. He is convinced that by indicating the series of hands through which they passed into his own, no step would be gained as to proving their authenticity. Seven portfolios of the same collection—that of Desmaizeau—have remained in London, where he died, and which may be found in the British Museum or elsewhere by proper search, which will serve to demonstrate most forcibly the authenticity of the last portfolio remaining in France, for the possession of which English amateurs have made vain endeavours since the death of Desmaizeau. It seems to us that he can say nothing more explicit; and the search for the portfolios of Desmaizeau, is the only reasonable way of putting an end to this painful discussion. Let the Royal Society of London order a commission of its members to examine seriously the autographs in the possession of M. Chasles. We repeat that the falsifying of these thousands of documents is an utter impossibility. And the fact that the pretended forger makes the relations between Newton and Pascal date as far back as the time when Newton was only 14 years old, is in itself a convincing proof of their authenticity.

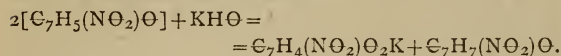
M. Le Verrier made a discourse in which he tried to demonstrate, in the most positive manner, the false origin of the astronomical documents attributed to Pascal. The President, and the Secretary, M. Eli ede Beaumont, begged of him to reserve his proofs for the commission, to which was referred the proposition of M. Faugère. M. Le Verrier insisted on being heard by the Academy, inasmuch as that the overwhelming proofs in his possession, will arrive soon from England; but the language of M. Le Verrier was so far from being academical, and so injurious to M. Chasles, that it was received with marked signs of disapprobation by the whole assembly. M. Saint Claire Deville read a letter, in which M. Kirchhoff answered to a question made by M. Chasles, as to his theory of solar spots.

Father Secchi read a paper on the admirable water conduits made in the Roman Compagna with full success.

Volatility of Sesquichloride of Iron at Common Temperatures.—When sesquichloride of iron is rendered very acid by hydrochloric acid, the vapour therefrom colours a solution of sulphocyanide of potassium faintly red, when allowed to impinge upon it for a short time.—William Skey, New Zealand.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Benzyllic Ether, Nitro-derivatives of.—Ed. Grimaux. Nitrobenzoyle hydride dissolves in alcoholic potassic hydrate, with formation of potassic nitrobenzoate, and an oil which probably is nitrobenzyllic alcohol. The reaction takes place in the following manner:—

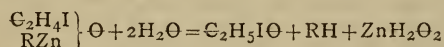


This oil cannot be distilled at ordinary pressure without undergoing decomposition; in a vacuum it boils between 178° and 180°C . Phosphoric chloride converts it into nitrodracetyl chloride (the nitrobenzyllic chloride of Beilstein and Geitner, *Ann. Chem. Pharm.* cxxxix. 337), which, on being boiled with an alcoholic solution of potassic acetate, forms the ether $\text{C}_6\text{H}_4(\text{NO}_2)\text{CH}_2(\text{C}_2\text{H}_5\text{O}_2)$.—(*Comptes R.* lxxv. 211.)

Orcin, Methyl-, Ethyl-, and Amyl-derivatives of.—V. de Luynes and A. Lionet. The action of alcohol-iodides and potassic hydrate upon orcin gives rise to the formation of three series of compounds, in which, according to the conditions of the experiment, one, two, or three atoms of hydrogen of orcin are replaced by alcohol-radicals. The authors have prepared by this method—

1. Methyl-orcin, $\text{C}_7\text{H}_7(\text{CH}_3)\text{O}_2$,
ethyl-orcin, $\text{C}_7\text{H}_7(\text{C}_2\text{H}_5)\text{O}_2$,
and amyl-orcin, $\text{C}_7\text{H}_7(\text{C}_5\text{H}_{11})\text{O}_2$.
 2. Diethyl-orcin, $\text{C}_7\text{H}_6(\text{C}_2\text{H}_5)_2\text{O}_2$,
and diamyl-orcin, $\text{C}_7\text{H}_6(\text{C}_5\text{H}_{11})_2\text{O}_2$.
 3. Trimethyl-orcin, $\text{C}_7\text{H}_5(\text{CH}_3)_3\text{O}_2$,
triethyl-orcin, $\text{C}_7\text{H}_5(\text{C}_2\text{H}_5)_3\text{O}_2$,
and triamyl-orcin, $\text{C}_7\text{H}_5(\text{C}_5\text{H}_{11})_3\text{O}_2$.
- (*Comptes Rendus*, lxxv. 213.)

Glycolic Hydriodate, and New Synthesis of Alcohols.—A. Butlerow and M. Osokin. Glycolic hydriodate (iodhydrin) $\text{C}_2\text{H}_5\text{IO}$ is readily formed by the action of potassic iodide upon glycolic hydrochlorate; potassic chloride and iodide are extracted from the mixture by water; the remaining oil is washed first with a solution of sodic hydrate, then with water, and finally dried over dehydrated sodic sulphate, and distilled in a vacuum. Iodhydrin is energetically acted upon by zinc methide or ethide, and if water is added to the product of the reaction, iodhydrin is again formed, besides hydrocarbons:

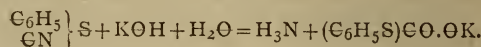


If, however, certain conditions are observed during the reaction, the alcohols $\text{C}_2\text{H}_8\text{O}$ and $\text{C}_6\text{H}_{10}\text{O}$ may be obtained.—(*Zeitschr. Chem.* N.F. iii. 369.)

Acetic and Oxyisobutyric Acid.—Markownicoff has prepared acetic acid according to Städeler's method, and compared it with oxyisobutyric acid. He finds that they agree as regards the temperature required for their sublimation (50°C .) and fusion (79° — 80°), and that their characteristic zinc-salts show the same properties. From these experiments, and others published on a former occasion (*Zeitschr.* ii. 502), the author concludes that Frankland's dimethoxalic acid, Städeler's acetic acid, and his oxyisobutyric acid, first obtained from monobromisobutyric acid, are identical.—(*Zeitschr. Chem.* N.F. iii. 434.)

Sulphophenyle.—C. G. Wheeler. By the reduction of phenylsulphonic chloride by means of zinc and sul-

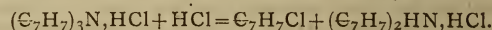
phuric acid, phenylic sulphhydrate and phenylic bisulphide are formed. On dissolving the mixture of the two in warm alcohol, the bisulphide is obtained in crystals, while the oily sulphhydrate remains in solution. Bromine acts readily upon phenylic bisulphide, forming a crystalline body of the composition $\text{C}_6\text{H}_5\text{BrS}$, which is readily soluble in ether, moderately so in alcohol, insoluble in water. The author intends to convert this bromide into a cyanide, which on being treated with potassic hydrate is expected to yield an acid corresponding to oxybenzoic acid, and identical, perhaps, with the acid obtained from potassic sulphhydrate and chlorbenzoic acid. The reaction would be the following:—



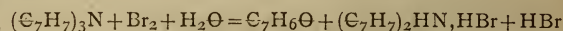
(*Zeitschr. Chem.* N.F. iii. 436.)

Benzyl-Amides.—H. Limpricht. The action of alcoholic ammonia upon chlorbenzyl gives rise to the formation of mono-, di-, and tri-benzylamine, which may easily be separated by converting them into hydrochlorates and subjecting the latter to fractional crystallisation.

Tri-benzylamine crystallises in large plates; it may be distilled in small quantities at above 300°C . without undergoing decomposition. The chlorhydrate, heated in an atmosphere of dry chlorhydric acid to 250°C ., is resolved into chlorbenzyl and dibenzylaminic chlorhydrate:



The free base, when distilled with bromine and water, gives oil of bitter almonds and bromhydrate of dibenzylamine:

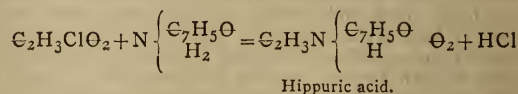
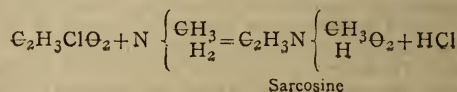


A similar reaction takes place when heated with iodine and water in sealed tubes to 120° . Dry bromine added to an ethereal solution of tribenzylamine precipitates an amorphous yellow body of the composition $(\text{C}_{21}\text{H}_{21}\text{N})_2\text{Br}_6$. Fuming sulphuric acid converts tribenzylamine into a sulpho-acid, the baric salt of which has the formula $\text{C}_{14}\text{H}_{13}\text{NS}_2\text{O}_6\text{Ba}$.

Dibenzylamine is a thick colourless liquid, insoluble in water, readily soluble in alcohol or ether. It forms well crystallisable salts with chlor-, brom-, and iodhydric acid, which are soluble in hot water, sparingly so in cold.

Monobenzylamine awaits further investigation, not having been obtained in sufficient quantity.—(*Zeitschr. Chem.* N.F. iii. 449.)

Hippuric Acid, Synthesis of.—N. Iazukowsitch. The reaction by which sarcosine (methl-glycocyne) is formed (acting upon chloroacetic acid with methylamine) may be employed for the synthesis of hippuric acid (benzoyl-glycocyne), using benzamid instead of methylamine:



Equivalent quantities of benzamide and chloroacetic acid were heated in a sealed tube to 150° — 160°C . The contents of the tube, which had become solid on cooling, were extracted with ether, the insoluble portion saturated with calcic hydrate, and the calcic salt analysed; it had the composition of calcic hippurate $2(\text{C}_6\text{H}_5\text{N}\text{O}_2) \cdot \text{Ca} + 3\text{H}_2\text{O}$, the acid obtained from this salt by precipitation with chlorhydric acid, had the composition of hippuric acid, $\text{C}_9\text{H}_9\text{N}\text{O}_3$.—(*Zeitschr. N.F.* iii. 466.)

CORRESPONDENCE.

DR. CLAUS ON SUCCINIC ACID.

To the Editor of the Chemical News.

SIR,—Under the title "Claus on Succinic Acid," Mr. Church communicated in the *Laboratory* an answer to the remarks which I have made, concerning his experiments on the action of nascent hydrogen on oxalic and succinic acids. I am sorry to be forced to take notice of this reply of Mr. Church; sorry the more as the reply misrepresents what he said in his first communication; and I am forced the more as Mr. Church appears to charge me with such a misrepresentation.

With respect to the first point, that Mr. Church did not assert, that oxalic acid yields by reduction a substance isomeric with acetic acid—I cannot know in how far he himself lays stress upon his own examinations, and if Mr. Church said: "If the preliminary examination of these substances has conducted me to a correct conclusion, I am right in supposing the last-mentioned acid to have the formula assigned to it, we have a new isomer of acetic acid;" I must think Mr. Church himself believes that he is right in his speculations, and in this supposition I quoted Mr. Church's communication. But Mr. Church himself seems to know very well how much, or better, how little authentic his examinations are, and I now share this view with him entirely, and I promise, in the future, never more to quote any of his communications or to believe them.

The second point, that Mr. Church pretends never to have stated, "that succinic acid might be made to yield butyrlactic acid," is wrong, and in his citation all that he said about *this* acid is left out. Mr. Church quotes from his communication: "I have commenced a few experiments in this direction also . . . But the products," &c. What Mr. Church here leaves out and signs with the three points is verbatim as follows:—

"Succinic acid, after the prolonged and energetic action of nascent hydrogen as above described in the case of oxalic acid, suffers a similar change. I have not endeavoured to moderate the action so as to form the intermediate, or butyloxylic acid, but have pushed it to the extreme, so that butyrlactic acid might be obtained. The operation was performed in a retort; towards its conclusion a powerful odour, resembling that of butyric acid, was noticed in the aqueous distillate. The mixture of zinc-salts in the retort was evaporated, sulphuric acid added in excess, and the liquid shaken up with ether. From this ethereal solution (besides some unchanged succinic acid) a deliquescent acid was obtained, the properties and salts of which agreed completely with the butyrlactic acid of Wurtz. I have likewise submitted suberic and phthalic acids to the above described treatment, and the reactions promise interesting results." But Mr. Church's last remark: "and it would be altogether premature to express any opinion as to their composition" belongs not to the butyrlactic acid, but to the products of these reactions on suberic and phthalic acid.

I suppose Mr. Church never thought that his answer would come into my hands, otherwise I cannot understand how he could thus deny his own words. I do not like to discuss this behaviour of Mr. Church in your journal, but for the sake of the truth I must ask you to make this letter public.—I am, &c.

A. CLAUS.

Freiburg, August, 1867.

*. The following is Professor CHURCH's communication referred to in the above letter:—

"The researches of M. Claus have shown certain results contradictory, according to this chemist, of my earlier experiments. Would you permit me to deny the assertions put into my mouth by M. Claus? I will do so very briefly.

(1) I did not assert that oxalic acid yields by reduction 'a substance isomeric with acetic acid.' (2) I never stated

that 'succinic acid might be made to yield butyrlactic acid.' All my experiments were merely preliminary, and, as the following extracts from my paper* show, were not deemed by myself to be adequate proof of my anticipations.

"If the preliminary examination of these substances has conducted me to a correct conclusion, and I am right in supposing the last-mentioned acid to have the formula assigned to it, we have a new isomer of acetic acid.

"It will not be unreasonable to expect corresponding results from the action of nascent hydrogen on the homologues and analogues of oxalic acid, and the acid and neutral ethers of these acids.

"I have commenced a few experiments in this direction also. . . . But the products of these reactions, obtained only within the last few hours, await further purification and analysis; and it would be altogether premature to express any opinion as to their composition."

"Royal Agricultural College, Cirencester,
April 23, 1867."

THE SCIENCE AND ART DEPARTMENT.

To the Editor of the Chemical News.

SIR,—Since the publication of the new Directory of the Department of Science and Art, after the annual examinations of 1867, we are now in a better position to understand the intentions of the Government with respect to its masters certificated in science; perhaps therefore you will permit me to re-open a subject of interest to no inconsiderable number of your readers.

On comparing the new Directory with the old, two important contractions strike us.

I. The omission of the list of certificated masters.

II. The omission of the rules for their special examination in November, they being henceforth required to undergo the same examination as students in May.

These significant changes taken in conjunction, render the supposition not improbable that the committee of the Council of Education meditate hereafter sweeping away the distinctions of the somewhat privileged class of certificated teachers, by first inundating it with a flood of new-comers of lower qualifications, and subsequently throwing down all boundary marks.

As the new rule stands, which came into operation this year, all persons above twelve years of age who shall have obtained a first or a second class at the May examinations of students, shall be deemed qualified to receive payments on results; *i.e.*, shall receive the monetary encouragement hitherto granted to certificated masters alone; this extension admits this year (I believe) between 1,000 and 2,000 additional teachers, and in the course of three years may be expected to swell the present total number of licensed teachers (about 400) to 5,000; this number will then be found too costly for the application of the former bonuses, and the Government grant will be withdrawn.

Nor will the preceptor have cause pecuniarily for complaint, since he has been yearly warned by the department that these allowances are temporary, and may cease whenever the system, whose infancy they were intended to foster, shall have acquired self-supporting vigour. He will, if provident, like the wise steward of the parable, make provision against the day of being cast out, and will seek some more permanent and less speculative remuneration. Here his Government certificate might be a recommendation if its *prestige* were not suffered to be dimmed in the eyes of the scientific public.

On the old plan each candidate for the diploma had to pass a practical as well as a theoretical test; *e.g.*, in chemistry three hours were assigned him to analyse and describe some such unknown mixture as silica with

* *Journal Chem. Soc.*, 1864 [2], p. 361.

sulphates of baryta and magnesia.* Thus every successful master was known to have some slight acquaintance with manipulation, while a certificate of the first grade implied a certain higher degree of proficiency in qualitative analysis. For this is now substituted an examination in theory of perhaps greater difficulty, coupled with the written answering of such questions as the following:—

Q. How is brass separated into its elementary constituents?

Q. A mixture contains Cu, Pb, Fe, Ba, Ca, Mg; how are the several constituents detected?

Q. What is the action of sulphide of ammonium upon sesquichlorides of iron and chromium and chloride of nickel?

But the examinee has an option of questions, and may omit all the practical, still obtaining the required first or second class; hence there is now hardly any guarantee that future candidates shall have any experience in the laboratory or in the handicraft of their profession.

This practical skill, however, in such subjects as chemistry, mineralogy, botany, physiology, and geology, is essential to their masterly understanding, and is moreover by far the more costly and laborious portion of the science to acquire.

This, if any, is the grievance of the old régime of masters, that they are liable to be confounded with a different class of aspirants; it might, however, be so easily removed by two trifling concessions from the department, that I am tempted to recommend, as they have courted suggestions—

I. Since the present examinations are wholly conducted in the evenings of May, that the mornings of the same days be partly devoted to an additional voluntary examination in the practical portion of such above-named subjects, and that to those candidates only who pass this probation should the masters' printed certificate be issued.

II. That in the register of certificated (which should be retained in some public form), those examined before 1867 should have some distinctive mark attached, *e.g.*, that of their grade.

This arrangement will save both the Government and the master expense; the additional trouble to the four or five examiners concerned will be small.

The department will thus, by equitable and conciliatory measures (considering the pre-eminent character of their noble phalanx of examiners), shortly attain to an influence upon the scientific studies of the country possessed by no other body, whether learned society or university; even in May last they examined 8,439 papers belonging to about 5,000 different individuals.—I am, &c., M. A.

MISCELLANEOUS.

Royal Polytechnic Institution.—A few evenings since, we visited this Institution by invitation from Mr. Pepper, and it gives us considerable pleasure to be able to commend the entertainment. The Polytechnic fulfils now, as it has for many years, a useful purpose, in instructing while amusing its audience. Many who would shrink from reading for instruction, or from attending strictly scientific lectures, would take pleasure in the entertainment given here, and at the same time learn a little of some branch of science. Those who have seen the various optical delusions and have heard the popular lectures on electricity, sound, light, &c., which have from time to time been delivered here, will refrain from quibbling. One of the leading features in the present entertainment is the lecture on the Paris Exhibition, which perhaps deserves the lion's share of praise. Few would imagine how good an idea of the Exhibition may be gained from this lecture; the positions for photographing seem well chosen. The photographs

are projected, magnified, on to a screen. Among those which were most noticed were the exhibitions of glass, of the fine arts from Italy, and of English designing, and machine-made jewellery; the photographs, too, of the intricate machinery display came out very clearly. In the reading of "The Bridal of Belmont," by Mr. Millard, a lighter feature in the entertainment is found. This poem offers a fitting subject for a ghost scene, and is taken advantage of; a rather curious musical instrument is also introduced here, which appeared to give great satisfaction. The only other point to which we need allude is the Automatic Leotard, which as a piece of mechanism is very clever.

NOTES AND QUERIES.

Clarifying Oxymels.—Oxymels can be obtained brilliantly bright without any body being used for their clarification, by keeping the honey at a temperature of 212 deg. Fahr. and separating the scum rising to the surface as long as any is formed, then filtering through twill cloth. The colour of the oxymel however, is much darker than the product obtained by the process of British Pharmacopœia 1867, which merely directs the honey to be melted.—SCILLA MARITIMA.

Development of Heat.—In my early chemical days I was in the habit of attending lectures at the Polytechnic Institution, London. The lecturer, whenever he was discoursing upon heat, always brought in this story. "There is an old saying, that you may go to the Mint, and carry away as many sovereigns as you please, provided you pick them up with your naked fingers as they fall from the press." The reason you were allowed this privilege, was because they dropped from the die so hot it was impossible to hold them. Can any of your readers say whether the story is a myth, or is it founded upon some former press, as I visited the Mint a few days since, and found that the coin came from the stamp comparatively cold.—VRAISEMBLANCE.

Preserving Fresh Flowers.—Flowers may be kept in pretty fair condition, for say a week or ten days, according to the species selected for bouquets and the time of the year, by renewing the water every alternate day, and while doing so rejecting decayed flowers and leaves, and taking care to cut off from the stems immersed in water, with a sharp pair of scissors, about from a quarter to half inch of the length; then should be added to the water about a pinch of salt, and a few grains of saltpetre for every pint of fluid; when flowers are very much faded they may be revived by immersion of the stems for two or three minutes in hot water, or better yet in strong spirits of wine, or Eau de Cologne; in some cases liquid ammonia may be advantageously applied to the stems for a few minutes to revive flowers. These recommendations are applied by several of the largest horticulturists of Ghent and other parts of Belgium, and found to answer in practice very well if properly applied. To keep well flowers should not after being cut be placed in localities where there is tobacco-smoke, or bad ventilation, neither should the rooms be too much heated.—A.

TO CORRESPONDENTS.

Chemicus Junior.—They will be proceeded with.

F. J. Hawker.—The suggestion shall receive attention. We are greatly obliged for the same.

St. Helens.—Chinese blue is a synonym of Prussian blue. See CHEMICAL NEWS, Vol. xv., p. 370.

An Old Subscriber.—They were discontinued mainly because to do bare justice to the subjects would have nearly filled our columns each week. Everything of importance will still be noticed.

Messrs. Cocker, Brothers.—We are unable to give our correspondents the address required. A short note in our advertising columns would doubtless procure it.

W. H. Haverford West.—1. Plateau's description for preparing glycerin soap liquid was given in our 4th vol. page 290. 2. Dangerous in a small room. 3. The heat evolved in the combustion of a certain weight of mixed oxy-hydrogen gases is the same whatever the rate of combustion. 4. If our correspondent will favour us with a call we will see if an arrangement can be made.

Communications have been received from F. J. Hawker; Cocker, Brothers; G. Johnson (with enclosure); T. J. Reeves (with enclosure); R. Jamieson (with enclosure); Dr. A. Claus (with enclosure); Rev. C. W. Kett; R. E. Bibby; C. Umney (with enclosure); F. Peckham (with enclosure); W. H. Hofman (with enclosure); E. C. Durham; W. Graves (with enclosure); R. M. Brown; W. Andrew (with enclosure); A. B. King (with enclosure); H. Henson; — Remington (with enclosure); F. O. Jackson (with enclosure); B. Simpson; A. Jones; M. Wilson Smythe (with enclosure); W. Bird; Samuel Higley (with enclosure); J. Cliff; C. Nelson; B. W. Gibsons; W. Bywater; J. W. Swindells.

Books Received.—"An Introduction to Pharmaceutical Chemistry," by John Attfield, Ph.D. F.C.S. London: Van Voorst. "The Ophthalmic Review," by J. Zachariah Lawrence. London: Hardwick. "Squire's Companion to the British Pharmacopœia, 1867." Fifth Edition. London: Churchill. "Practical Hints to the Medical Student," by William Allen Miller, M.D. LL.D.

* An actual exercise proposed in 1865.

THE CHEMICAL NEWS.

VOL. XVI., No. 412.

ON THE APPLICATION OF THE BLOWPIPE TO THE QUANTITATIVE DETERMINATION OR ASSAY OF CERTAIN METALS.

By DAVID FORBES, F.R.S., &c.

(Continued from page 29.)

Silver Assay—

B. METALLIC ALLOYS INCAPABLE OF DIRECT CUPELLATION.

b. Containing tin: argentiferous tin, bronze, bell and gun metal, bronze coinage, &c.

Alloys of silver with other metals containing tin do not admit of being cupelled, since the oxide of tin formed by the oxidation of that metal is not absorbed by the bone ash of the cupel along with the litharge, it consequently remains upon the surface of the cupel, and if present in any quantity interferes with the operation. As tin is not volatile when heated on charcoal either in the oxidating or reducing blowpipe flame it cannot be so dissipated, and in consequence, the entire amount of tin contained in any alloy under examination must be removed by oxidation or scorification from the silver lead, previous to its being submitted to cupellation.

For this purpose: 1 part of the stanniferous alloy is fluxed with from 5 to 15 parts granulated assay lead (according to the amount of copper suspected to be present in the alloy), 0.5 part anhydrous carbonate of soda, and 0.5 part pulverized borax glass, made up as usual in a soda paper cornet, and the whole at first gently heated in reduction flame, until the soda paper is charred and the alloy has afterwards united with the lead to form a single globule, whilst the borax and soda have combined as a glass or slag in which the soda prevents the easily oxidisable tin becoming oxidised to any extent before a perfect alloy has been formed with the lead, which then contains the whole of the silver.

As soon as this is effected, the blowpipe flame is altered to an oxidating one, and the metallic globule is kept at the point of the blue flame, which should touch it so as to cause the tin to become oxidised and be at once taken up by the glass surrounding it.

Should, however, it be seen that minute globules of metallic tin made their appearance on the outer edge of the slag or glass,* the operation must be at once discontinued, and the assay allowed to cool; after cooling the metallic globule is detached from the slag surrounding it, and being placed in a cavity on charcoal, is fused in the reducing flame along with a small piece of borax glass and afterwards treated with the oxidating flame exactly as before (and if necessary, which is seldom the case, unless when treating argentiferous block tin, this operation may again require to be repeated), until it is seen that the surface of the metallic silver lead globule does not any longer become covered with a crust or scales of oxide of tin, but presents a pure and bright metallic surface.

The silver lead globule is now quite free from tin, and can be cupelled and the amount of silver determined as usual.

c. Metallic alloys containing much antimony, tellurium, or zinc: antimonial silver and argentiferous antimony, telluric silver and argentiferous zinc.

Alloys of antimony with silver when treated on charcoal in the oxidating flame give off all their antimony, leaving the silver behind as a metallic globule having a frosted external appearance; telluric silver, on the contrary however, when treated in similar manner only evolves a part of its tellurium, and even after cupellation with lead a small amount of tellurium generally remains behind alloyed with the silver.

All these compounds may be assayed as follows:—

One part of the alloy is placed in a soda paper cornet along with 5 parts granulated assay lead, and 0.5 part pulverised borax glass, and fused in reducing flame until the globule and slag are well developed; the oxidating flame is now directed on to the globule, causing the whole of the zinc along with most of the antimony and part of the tellurium to volatilise before the lead commences oxidising. The last traces of antimony are removed with some difficulty, during which operation some portion of the lead becomes oxidised. On cooling, the globule is now separated from the slag and concentrated upon a coarse bone ash cupel as usual, and if no tellurium were present in the concentrated silver lead, this may now be cupelled as usual.

If tellurium is present, as is seen by the concentrated globule of silver lead possessing a dark coloured exterior, it must be remelted with 5 parts assay lead and again concentrated, and these operations, if necessary, must be repeated until the surface of the concentrated globule is found to be clean and bright as usual with pure silver lead, when it may be cupelled fine and the silver globule weighed.

It sometimes happens, even after all these precautions have been taken, that the silver globule after cupellation shows a crystalline, greyish white, frosted appearance from its still containing tellurium; in such cases its own weight of assay lead (in one piece) should be placed beside it on the cupel, melted together, and the globule again cupelled fine on another part of the surface of the same cupel. In assaying substances very rich in tellurium the results obtained are, however, not very satisfactory, and may be as much as one or two per cent too low, even after employing all precautions.

d. Compounds of silver with mercury; arquerite, native and artificial amalgams and argentiferous mercury.

The assay of these compounds is very simple. A weighed quantity of the liquid or solid amalgam is placed in a small bulb tube, and heated over the lamp very gradually in order to avoid spitting and to allow the mercury to volatilise quietly†; the heat is increased by degrees as long as any mercury is driven off, and the residue is heated for some time at a red heat in order to drive off as much mercury as possible without fusing the glass or causing the residual silver to adhere to it. The mercury expelled condenses itself above the bulb on to the upper part of the tube, and by gently tapping will collect in globules, which by carefully turning the tube unite and can be poured out of the tube; after which the silver, left behind as a porous mass, may be removed from the tube, and after being fluxed with an equal weight of granulated assay lead and half its weight of borax glass, must be fused on charcoal in the reducing flame, and the button on cooling cupelled as usual. Should, however, much copper have been present in the amalgam, a proportionately larger amount of assay lead is required to be added.

When the argentiferous residue is extremely small, as is often the case when assaying argentiferous mercury, this may adhere firmly to the glass of the tube. On such occasions this part of the tube must be cut off with the adherent residue, and the whole fused in a strong reducing flame along with its own weight of granu-

† In the case of solid amalgams, which often spirt very violently, this may be obviated by wrapping the assay in a small piece of tissue paper, and heating it in a blow-pipe crucible, when all the mercury is given off quietly, leaving the silver behind; a useful little dodge shown the author lately by Mr. Crookes.

* This occurs when the flux has become so saturated with oxide of tin that it cannot take up any more.

lated assay lead, and with half its weight of anhydrous carbonate of soda. Upon cooling, the globule of silver lead thus obtained is cupelled as usual.

(c.) Compounds chiefly consisting of iron; argentiferous-steel; cast-iron; bears from smelting furnace.

Compounds consisting principally of iron with a small percentage of silver, although occasionally produced in the arts intentionally, as, for example, the so-called silver steel, are commonly found on the blowing out of furnaces used in the smelting of silver and copper ores, and are frequently rich in silver, as is the case with the bears from the silver furnaces at Kongsberg in Norway. An alloy of iron with silver is occasionally also found appearing in small quantities on the surface of melted silver in the process of casting, and in some cases at least this may be due to the action of the melted silver on the iron rods used for stirring up the molten metal.

As iron cannot be made to alloy itself with lead before the blow-pipe, it becomes necessary to extract the silver by a more indirect process than is used in the case of other alloys containing that metal. In order to remove the iron the alloy must first be converted into sulphide of iron and silver, and to effect this, the iron or steel must be reduced to powder, or fragments none greater than about a quarter of a grain in weight; for which purpose steel when hardened may require to be softened previously.

One part of the finely-divided iron or steel is now mixed with 0.75 part sulphur, eight parts granulated assay lead, and one part pulverised borax-glass; the mixture after being placed in a soda paper cornet is carefully fused in a cavity on charcoal in the reducing flame, until the whole appears as a fluid globule containing both the lead and iron in combination with the sulphur. Without removing either this globule or the glass surrounding it from the charcoal, an amount of borax glass in one or more fragments (in all about equal in weight to the original amount of iron employed), is now added (in order to combine with and slag off the whole of the iron), and fused along with the former globule, after which the whole is submitted to a strong oxidising flame until the impure lead globule shows itself protruding from the slag.

The charcoal is then inclined so that the lead is alone subjected to the action of the outer flame, in order to volatilise the sulphur, and at same time oxidise the iron which goes into the slag; this operation is continued until the globule of lead appears with a bright metallic surface; should it on cooling, however, be found to possess a black colour, and to be brittle, it must be still further oxidised as before described.

The silver lead thus obtained will now be found to contain all the silver, and at the same time to be free from both iron and sulphur, and can be cupelled as usual.

No notice is here taken of alloys of silver and gold, since these metals cannot be separated before the blow-pipe by any process yet known; and in all cases where gold may be present in an alloy, treated as here directed for obtaining its contents in silver, the gold also will be found to follow along with the silver, and must be parted from that metal by the humid method, in order to enable the true amount of silver present in the substance to be ascertained.

The British Association.—A meeting of the Local Invitation Committee of Exeter and Plymouth for securing the visit of the British Association to one of these places in 1869, has been held to consider what steps should be taken to end the present rivalry. After much discussion, it was decided to refer the question to the last three Presidents of the British Association, Professor Phillips, Mr. Grove, and the Duke of Buccleuch, to say which town should retire and help the other.

ON ULTRAMARINE.

By DR. ERNST RÖHRIG.

(Concluded from page 189.)

SEVERAL other formulæ for producing ultramarine have been published. Only those already referred to have been mentioned, as the investigators have at the same time started some theory explaining the blue colouration.

Having been engaged in ultramarine manufacture for a number of years, I may also state that all the published modes of producing ultramarine are incapable of application to the manufacture on a large and lucrative scale, though they are all very well for analytical researches in the laboratory. I may be allowed to state here also, that the mixture for manufacturing ultramarine is not the only secret connected with it; there are many others besides, which manufacturers mostly obtain by many very expensive experiments.

The supposed colouring principle in ultramarine has been variously stated by different investigators.

Before the composition of lapis lazuli was known, it was believed that copper was the cause of the blue colour.

Marggraf* first confuted that opinion, and he attributed the blue colour to iron. Klaproth† was of the same opinion.

Guyton Morveau‡ also attributed the colouring matter to iron. He had observed that sulphate of lime containing iron became blue when heated with carbon, and that the blue colour disappeared again when it was acted upon with acids.

Varrentrap§ inferred from the analysis of nosean, sapphirine, lapis lazuli, and artificial ultramarine, that the intensity of the blue colour increased with the amount of sulphur and iron, and he considered it possible that the blue colour was attributable to sulphide of iron.

This analysis of artificial ultramarine gives the following numbers:—

Silica	.. .. .	45.604
Alumina	.. .. .	23.304
Soda	.. .. .	21.476
Potash	.. .. .	1.752
Lime	.. .. .	0.021
Sulphur	.. .. .	1.685
Sulphuric Acid	.. .. .	2.830
Peroxide of Iron	.. .. .	1.063
Chlorine	.. .. .	trace

98.735

Prückner|| stated that he could not produce ultramarine from clay which was free from iron; he, therefore, recommended an addition of green copperas, and was of opinion that iron was essential for the blue colouring.

Elsner¶ arrived, by a number of experiments, at the conclusion that the colouring principle was a combination of sulphide of iron and sulphide of sodium. He found that Gmelin's ultramarine base free from iron heated with sulphur and soda, also free from iron, produced a yellowish-white mass, whilst when using materials containing iron, a green mass was obtained.

Now, the supposition of iron being the blue colouring matter has a very weak foundation, since, on the contrary, it is proved by Gmelin, Desormes, Clement, Bounner, and Ritter, that ultramarine may be produced from materials free from iron.

Iron, and likewise lime, magnesia, &c., substances which are often to be met with in ultramarine, are only accidental components, and have no relation whatever to its blue or green colour.

* Marggraf's Chem. Schrifton, Berlin, 1768.

† Klaproth's Beiträge z. Chem. Kenntn. der Mineralien i. 189.

‡ Poggend. Annalen xlix. 521, 550.

§ Ann. de Chimie, xxxiv. 54.

|| Journal f. Pract. Chemie, 1844, bd. 3.

¶ Journal f. Pract. Chemie, xxiv. 285, xxvi. 106.

Desormes and Clement were the first who found, by analysing the natural mineral, that it contained no iron. This metal, therefore, could not be the colouring principle; but they expressed no further opinion on the subject.

Gmelin considered the sulphur as the cause of the blue colour. He thought he had observed that in decomposing ultramarine by hydrochloric acid, sulphuretted hydrogen gas and sulphuric acid were formed, and he concluded from this that either a metallic sulphide, together with a sulphate, were contained in ultramarine or hyposulphurous acid, which was decomposed into sulphuric acid and sulphuretted hydrogen, a decomposition of water taking place at the same time.

Gmelin seems to have given the preference to the latter supposition, which is yet clearly erroneous, as hyposulphurous acid, when separated from dilute solutions of its salts by means of an acid, becomes decomposed into equal equivalents of sulphurous acid and sulphur.

Schweigger Seidel* states that the colouring matter of ultramarine is Vogel's blue sulphuric acid (solution of sulphur in anhydrous sulphuric acid); but he does not prove how sulphuretted hydrogen gas could possibly be evolved from that acid; and, besides, there is no sulphuric acid contained in ultramarine.

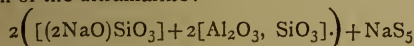
Elser called attention to the important fact that by decomposing ultramarine by means of acids, sulphuretted hydrogen gas was evolved, and that, at the same time, sulphur became separated. He found the proportion of the evolved sulphuretted hydrogen gas to that of sulphur to be—

In green ultramarine at 3·6 : 1 and
„ blue do. „ 1 : 7

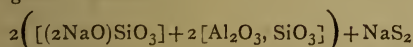
and he supposed that the blue ultramarine contained a higher degree of sulphuration of sodium than the green ultramarine.

Breunlin† was of the same opinion. A great number of analyses of the blue and green ultramarine induced him to consider that both kinds of ultramarine consisted of a combination of a nephelin-like silicate and sulphide of sodium, the latter in blue ultramarine having the formula NaS_3 , and in green ultramarine, NaS_2 .

He made the following formula to represent the composition of the ultramarine :—



and for green ultramarine—



Gentel‡ found also by analysing different yellowish-green sorts of ultramarine, a proportion of evolved sulphuretted hydrogen gas and separated sulphur corresponding to NaS_2 , but he is of opinion that the green ultramarine has a very different composition, and he assumes that it contained a mixture of different combinations of sulphur with sodium. He found in one sample of blue ultramarine a proportion corresponding to NaS_{10} , and he thinks it not improbable that ultramarine consists of a silicate of alumina, and a combination of silicate with sulphide of sodium. But he considers the proportions not sufficiently ascertained to justify forming a formula.

Wilken§ concluded from this mode of producing ultramarine that the blue colouring principle was hyposulphurous acid in combination with soda and NaS .

Stolzel|| considered sulphite or hyposulphite of soda to be the cause of the blue colouration.

Brunner¶ supposed that blue ultramarine contained oxidised sulphur; but he made this supposition from an

erroneous observation (influence of burning sulphur upon green ultramarine).

Ritter has drawn from his investigations on the subject the following conclusions :—

1. The combination formed by heating NaS together with silicate of alumina is colourless, and consists of silicate of alumina and soda and NaS , and a higher sulphide of sodium; this compound contains no combination of oxygen with sulphur.

2. By extracting some sodium from the white ultramarine (by the action of Cl or SO_2) a corresponding quantity of S will combine with the remaining NaS , and form a higher sulphuret of sodium.

3. The white ultramarine converted in such way absorbs oxygen (one part of the NaS being transformed into an oxygen compound), and takes the blue colour. The blue ultramarine, therefore, forms a combination of a silicate of alumina and soda, polysulphide of sodium, and sodium salts with one of the oxides of sulphur.*

4. It is probable that the combination of O with S contained in blue ultramarine is either as sulphite or hyposulphite of soda; the latter is the more likely.

5. KS , when heated with silicate of alumina, does not form an ultramarine-like combination; the result is a silicate of alumina and potash free from sulphur.

We know that sulphur may take a blue colour in three cases :—

1. When sulphur is in combination with anhydrous sulphuric acid;

2. By melting Rhodanide of potassium at a temperature approaching a red heat;

3. The sulphur which gets separated in mixing sulphuretted hydrogen with chloride of iron.

Considering these facts, it may be possible that a blue modification of sulphur may exist in ultramarine.

ON THE CONSTITUTION AND PROPERTIES

OF THE

HÆMATITE IRONS OF WEST CUMBERLAND

By EDMUND G. TOSH, Ph.D.

(Concluded from page 203.)

As I mentioned in the earlier part of my paper, the quantities of sulphur and phosphorus, particularly the latter, in iron, are not very materially lessened by its conversion into steel by the Bessemer process, hence only those varieties of crude iron can be used which contain an exceedingly small proportion of these elements, otherwise the resulting steel would be of very inferior quality and possess the properties of cold and red-shortness in an objectionable degree. This is a drawback to the very general application of the Bessemer process; as only in exceptional cases are irons of sufficient purity to be met with. Numerous attempts have been made to remove these substances, and many patents have been taken out with the same object, but as yet none have been successful. Calvert recommended the use of common salt, but its volatility at the extraordinarily high temperature of the metal while undergoing decarburization was an impediment to its employment. Recently a patent has been taken out by Wintzer, a Hanoverian ironmaster, for the use of chloride of calcium for the removal of these objectionable substances. If chloride of calcium have the effect desired, a great obstacle will have been overcome, but I have not heard of any experiments having been made with it.

I have estimated sulphur, phosphorus, and silicon in a specimen of steel made from Harrington pig (II. in the table). The percentage amounts in the steel respectively are as follows :—

* Schweigger's Journ. liv. 280.

† Ann. de Chemie u. Pharm., xcvi. 293.

‡ Dingl. polyt. Journ., cxli. 116.

§ Ann. de Chem. und Pharm., xcix. 28.

|| Ann. de Chem. und Pharm. xcvi. 35.

¶ Poggend. Annalen, lxxv. 541.

	Iron	Steel
Sulphur	0·075	0·034
Phosphorus	0·055	0·046
Silicium	2·286	0·172

Red-shortness.—I have already observed that malleable bars made from hæmatite pig iron by the ordinary process of puddling, are so exceedingly red-short as to be almost useless. A piece of this iron at a dull red-heat is so brittle that it breaks into fragments after a few blows under the hammer. This most remarkable and undesirable property can not in the present instance be ascribed, as it usually is, to the presence of an excessive quantity of sulphur, for even the raw hæmatite iron contains a less proportion of that element than the refined malleable bars of the best Swedish and English makes, such as Dannemora and Lowmoor; and it is very unlikely that the amount of sulphur should increase by puddling.

The Cumberland pig irons are as a class rich in silicium, and on the other hand contain very little manganese, and I am inclined to think that these co-existing peculiarities of constitution point towards the true cause of red-shortness in the present case. Caron* made the very interesting observation that at a high temperature in an oxidising atmosphere, manganese possessed the power of removing silicium from iron. This property at once assigns to manganese a place of high importance in connection with many operations in the metallurgy of iron, particularly that of puddling. Until spiegeleisen began to be used in making Bessemer steel, and its beneficial influence forced itself to be recognised, the action of manganese was greatly ignored by many practical men, at least in Britain. Any literature we have on this neglected subject is, for the most part, of an exceedingly vague description: the determination of manganese in iron by commercial analysts is often looked upon as a matter of minor importance, hence we have no good grounds to go upon in seeking to understand the action of this substance. It is, however, highly probable that in the removal of silicium by puddling, manganese plays a very important part, and looking upon the small proportion of this metal in hæmatite pig iron, in forcible contrast with the large amount of silicium, it is very possible that a comparatively large percentage of the latter element remains combined with the iron, exerting upon it a most deleterious effect, and causing the red-shortness in question. Unfortunately I have not a specimen of the malleable iron at my disposal, otherwise I might test, by chemical analysis, the value of these remarks.

Titanium.—This substance exists in small quantities in all the hæmatite irons I have examined, very probably combined with cyanogen and nitrogen, forming cyano-nitride of titanium, the composition of which was first shown by the classical researches of Wöhler.† Although the effect of its presence in iron is not distinctly known, the prevailing opinion among chemists and metallurgists is, that the cyanogen compound being probably merely diffused through the metal, and not chemically combined with it, its influence is very small. In repairing the blast furnaces in the Cumberland district, very considerable quantities of this cyano-nitride of titanium are found in the vicinity of the hearths, generally in the irregularly shaped lumps which though black and dull on the outside, exhibit when broken an exceedingly beautiful copper-coloured mass of crystals, among which a little iron is diffused. All crystals I have seen were octahedral, and although I have tried several times to obtain a perfect octahedron by dissolving away the surrounding iron with dilute hydrochloric acid, I have not succeeded. The faces of the crystals are rough and striated, resembling occasionally the skeleton of a crystal of common salt.

I examined the blast furnace slag for titanitic acid, and found that it contained a mere trace.

Nitrogen, as it occurs in iron, stands in close relation with titanium. According to Caron† it is to be found to a greater or less extent in all commercial iron, from which it can only with the greatest difficulty be perfectly removed. The proportions of the titanium and nitrogen in these hæmatite irons, as determined by me, are not by any means those which are found in cyano-nitride of titanium, but where quantities are so small the unavoidable errors of analysis may account for any such difference.

Although somewhat out of place, I would here make some remarks upon a specimen of slag from one of the Cumberland blast furnaces, which when analysed was shown to have the following composition:—

		Oxygen.
Silica	30·200	16·11
Alumina	12·007	
Protoxide of Iron ..	1·269	
Lime	50·507	21·58
Magnesia	2·553	
Alkalies	1·225	
Sulphide of calcium ..	2·400	
Phosphoric acid	trace	
Titanic	trace	
Protoxide of manganese	trace	
	100·173	

The percentage of silica is strikingly low, and if it be calculated it is found that the bases are very considerably in excess, the relation of oxygen being about 8 in silica to 10 in the bases.

I have often heard of the loss some of the companies in this district experience from the rapid wearing out of the furnace lining; sometimes after only three months working, or even less, the fire bricks were quite burned through. If the specimen analysed represents the slags usually produced, and is not a very exceptional case; this destruction of the furnace lining is easily explained. If unneutralised bases cannot find silicic acid in the ores to combine with, they will seek it elsewhere, and coming in contact with the firebrick lining will at once attack the silica in it, causing this disastrously rapid wear and tear of which I have heard so many complaints. In order to remedy this evil, furnace managers must either use less limestone or a larger quantity of siliceous matter.

This slag was of very vesicular and open structure, and of a greyish colour, agreeing closely with another described by Percy§, which he looked upon as a highly basic silicate, a conjecture fully confirmed by my analysis.

The Bessemer process, as yet in its infancy, presents a most interesting subject for study and examination. The chemical reactions involved in the process are still imperfectly understood, and a careful series of observations of the phenomena which are presented during its performance, while leading to a correct knowledge of the changes which take place during the conversion, would I have no doubt give us much more correct and reliable views as to the internal constitution of raw iron than any which we hitherto possess.

Solubility of Anhydrous Alumina in Ammonia.—If alumina is heated to whiteness, and pounded up fine, then allowed to remain in contact with ammonia for a few hours, a tolerably heavy gelatinous precipitate is produced by chloride of sodium, or ammonium.—William Skey, New Zealand.

ON A NEW TEST FOR HYPOSULPHITES.

By M. CAREY LEA.

IN an examination of the platinum metals which I published some time back in this journal, I described a very delicate test for ruthenium, by which the faintest traces of that metal could be detected through the agency of hyposulphite of soda. Recently, having occasion to test for the last-named substance, it occurred to me as probable that ruthenium might be rendered available for that purpose. This I found to be the case, and that the reaction exhibited considerable delicacy. It is true that ruthenium is at present a very rare metal, and not within the reach of all who might wish to use it, but the changes from rarity to more or less abundance are now so common and sudden that present scarcity is no reason for ignoring any useful reagent.

When a solution of ruthenium is rendered alkaline by ammonia and boiled with hyposulphite of soda, it gradually assumes a rose colour which passes into a rich carmine; with strong solution the colour is so intense as to be almost black. When diluted the shade is magnificent, rivalling the aniline red in richness.

I have already stated within what limits ruthenium can be detected by hyposulphite of soda. I now subjoin the limits observed with respect to hyposulphite of soda.

A solution containing one four-thousandth of hyposulphite, gave a clear rose red.

One containing one twelve-thousandth gave a well marked pink liquid.

One containing one twenty-five-thousandth gave a salmon colour.

The experiment was not carried further because the salmon colour in the last-mentioned trial showed that the test had then reached its practical limit. I do not doubt that even with one hundred thousandth a colouration could be obtained, but it would not have the specific distinctness given by the carmine and rose shade previously described.

A few words remain to be said as to the best mode of applying this test.

I have recognised in solutions of sesquioxide of ruthenium a strong tendency to decompose by dilution; dilute solutions have a strong tendency to gradually deposit their ruthenium as oxide. And even before the slightest sign of a precipitate appears, in fact immediately upon dilution, solutions show a tendency to change their reactions. So that I find it invariably better on diluting the ruthenium solution for use in testing, to boil it (as I have elsewhere pointed out in speaking of the dilution of ruthenium) with a few drops of hydrochloric acid, and this even although the solution is to be immediately afterward rendered alkaline by ammonia. To ascertain with certainty that this improved the delicacy of the reaction, I made comparative experiments on two portions of the same ruthenium solution, and found that the colouration by hyposulphite was at least three times stronger in the case of the portion that had been boiled with HCl than with that that had not.

As ammonia was thereafter immediately added, it might appear that the function of the hydrochloric acid was to form hydrochlorate of ammonia. But it was found by experiment that the addition of sal-ammoniac in no way aided the reaction.

The addition of ammonia to a hot solution of sesquichloride of ruthenium immediately darkens it to a blackish olive colour, which, according to the dilution and the light that falls on it, is of a reddish or a greenish shade. By standing, the ruthenium is precipitated as oxide. As this condition is the necessary preliminary (as before explained) to the production of the characteristic carmine reaction, it is not a little singular that the delicacy of that reaction should be so greatly enhanced by taking steps to strengthen the combination with excess of acid and boiling, immediately before the affinities are to be loosened by ammonia.

In using this reaction for the detection of small quantities of hyposulphite, it is useful to remark that it succeeds best when very little ruthenium is present. After the ruthenium solution has been boiled with acid and super-saturated with ammonia, and the liquid to be tested for hyposulphite added, the mixed solution should have so little ruthenium in it as to exhibit only a very pale transparent olive colouration—should in fact be almost without colour. Otherwise if the hyposulphite is present in mere traces, we get a salmon or flame colour instead of the pure carmine.—*American Journal of Science*, September, 1867.

PRACTICAL HINTS TO THE STUDENT.*

By WILLIAM ALLEN MILLER, M.D., LL.D., V.P.R.S.

Professor of Chemistry in King's College.

I shall best consult the wishes of those whom I represent, and shall be doing what is most fitting upon such an occasion, if I aim at usefulness rather than novelty; and for that purpose I shall direct my remarks chiefly to those who are just commencing their career among us, and who may perhaps not unnaturally feel some degree of perplexity and apprehension at the formidable array of studies to which they are now at once introduced as a preliminary to the practice of their profession.

It will not be sufficient for any one of you, however diligent, to content himself with mere attendance upon lectures. Admirable as these may be, they can only present an outline of the subject, which the student must fill up by reading and reflection. No man can really do the work of thinking for another, if that other is to be anything more than a cypher. The most important part of every man's education is that which he gives to himself. He must learn to master his own mind, and to conquer the tendency which everyone naturally has to prefer ease to persevering work. When once the habit of steady application has been acquired, all others are comparatively easy.

In preparing yourselves for the practice of your profession, your great object must be to seize upon the principles of each branch of your studies; and it is here that good lectures are of such value in directing the mind of the student. Do not suppose, however, that I wish you to undervalue the acquisition of even very minute details in certain cases. Details indeed are not to be despised or neglected, for it is upon the mastery of detail that all successful practice depends. All acquired knowledge, to be valuable, must be precise as far as it goes; but the selection of those points that must be filled up minutely, and the omission of details where the knowledge of the principle only will suffice in others, are essential conditions to success in study; and in such cases a hint obtained from the Professor may often save you many an hour of profitless labour. For example—The custom of taking notes during lectures is one which may be beneficial or injurious, according to the mode in which it is carried out. If judiciously managed, it may be of great value. Unless, however, you are a master of shorthand it would be a mistake to endeavour to take down all that is said. The great value of notes of lectures will be to guide you in your subsequent reading; but since most of the details given in systematic courses of lectures will be found in the text-books upon the subject, it would be waste of effort to do more than preserve the heads and main divisions of the discourse. If more be attempted, the attention is in danger of being distracted by the mechanical effort of writing, and the drift of the argument of being lost in consequence. It will often be useful to take down

* Extracts from an Introductory Lecture at the opening of the Medical Session at King's College, London, October 1, 1867.

ferences to books, numerical details, and special information of any kind. If it is an experimental lecture, a list of the illustrations employed may be preserved; whilst a sketch of any particular piece of apparatus, or of the arrangement of an experiment, will frequently both save a long description and recall the whole more vividly to the memory. In short, good notes to a lecture are like an index-map to an intricate country, upon which a few of the leading rivers, mountains, and cities are clearly marked out.

Every student who aspires to distinguish himself—and who is there among you that does not?—must set apart methodically certain portions of the day for study. Four or five hours a day spent in real study, in addition to the time occupied in the class-room, in dissecting, and at the hospital, will be as much as will be profitable to most men. The mental food, like the food for the body, must be digested and assimilated, otherwise it will not become part of the mind, nor will it be available for use.

This systematic and orderly arrangement of your studies will be greatly facilitated by the custom of drawing up every evening a plan for your work on the following day; it will preserve you from indecision, and will save time as you pass from one pursuit to another in its due order. You will then also be in less danger of falling into the habit of procrastination, which so often ruins a promising character. If you know that a thing which must be done can be done at once, do not postpone it. The recollection of the duty will either hang uneasily over you, and rob you of your repose, or else you will become indifferent; the habit of delay will be confirmed, and your power over yourself will be weakened.

The first requisite to successful study is the concentration of the powers of the mind upon the subject in hand; and this concentration of the faculties, though a voluntary act, is difficult at first to accomplish, but it gradually becomes easier by repeated practice. A well-trained mind will find that this process will afford invaluable aid to the memory, even when not naturally retentive, whilst it will enable one endowed with a really strong memory to acquire a knowledge, at once ready and accurate, of any subject which he may select.

We often hear complaints of memory on the part of those who really ought to blame themselves for want of attention. The same man who complains that his memory is so bad that he forgets what he has read as soon as he has closed the book, will, nevertheless, often give you the particulars of a boat-race, or of a game at cricket, or of football, in which he was himself personally interested, with the minute details of every incident, showing no want of memory in this case, where his bodily and mental powers were called into full activity.

The mind must be directed to the subject for a certain time with a view to remembering it, and the idea must be strengthened by repetition. Systematic repetition or review of the leading features of the subject under study should never be neglected. It is irksome, but indispensable. This habit of directing the mind intensely to whatever comes before it in reading or observation should therefore be cultivated by all means in your power, and the opposite habit of listless inactivity should be carefully guarded against, for in this lies the foundation of a sound intellectual character.

Next to attention, there is nothing that affords so important an aid to the memory as the habit of associating ideas correctly with each other. The constant practice of tracing the relation between new facts and those already acquired; the custom of referring facts to the principles which they confirm, illustrate, or extend, is of the utmost value; since it not only fixes the new facts firmly in the memory, but it refers them to their proper place in the mind, thereby enabling you to recall them in connection with the subject itself to which they relate. This mental operation is most important to prevent confusion of mind. Indeed, it is not less necessary than the corresponding mechanical process

of arranging one's papers; in which every one at once feels the importance of separating those relating to different subjects, while those referred to allied ones are placed together, each series being indicated by its appropriate label.

The habit of correct association may be attained by any one, but it requires assiduous cultivation. It not only exerts a great influence upon the acquisition of knowledge, but also upon the formation of the mental characteristics; and it is closely connected both with that activity of mind which it is so important to foster, and with that soundness of judgment upon which so much of the solidity of a character, and its usefulness to others, must depend in future life.

In many sciences our knowledge rests upon an assured and exact basis. This certainty depends upon the facility with which we can trace effects to their true causes, can predict the effects of known causes, and consequently can calculate upon the absolute uniformity with which particular results may be obtained. This is a certainty which can be secured so long as we are dealing with limited portions of inanimate matter. We can determine with absolute accuracy the effects of a mechanical combination, and we can predict the results of a chemical experiment which we have already tried. If the consequence which we expect does not follow, we are sure that some unobserved disturbing agent has prevented the conclusion which we anticipated; and a little observation will enable us to discover and obviate its effects. It is our accurate knowledge which gives us the power that in so many instances we possess over material objects; and we must remember with Bacon, "*Natura non nisi parendo vincitur.*"

The knowledge of the philosopher differs from that of the uneducated man less in kind than in degree, and in the manner in which it is acquired. In addition to the observation of the phenomena as they occur, the man of science institutes *experiments*; that is to say, he arranges and selects certain circumstances and excludes others, so as to enable him to determine what are the necessary, and what the merely accidental antecedents of the phenomena which he is examining; and upon the skill with which those experiments are arranged depends his progress in the discovery of scientific truth.

Now, in medical science there are sources of uncertainty which do not exist in physical science. One of the most important of these arises from the fact that, in most cases, we cannot make experiments and vary them at pleasure. In nearly every case of disease we must content ourselves with the observation of the phenomena: and how much lies hid even from the most careful observation! We see complex results only, but cannot trace all the conditions necessary to produce them. Hence accurate inferences can be deduced only by slow degrees; and hence it is in so many instances difficult to estimate the true value of the conclusions at which we have actually arrived.

* * * * *

The remaining subject with which you will be engaged during your first winter session is *Chemistry*; by which you are taught the nature, properties, and modes of combination of the different kinds of matter; a science of vast extent, and of fundamental importance to you. From its wide range, and its difficulty, there is no branch which the student is more often tempted to neglect than this, although its bearing upon the practical part of his profession is unquestionably very great. It will be my business, after impressing upon you its leading principles, to endeavour to guide you in selecting those parts of the science which admit of direct application to your profession. For instance, the microscopic investigations of the physiologist and the pathologist would be partial and incomplete if the various tissues were unravelled only by the aid of the scalpel or the needle. The judicious use of solvents, the application of tinctorial agents, and the

various expedients of microscopic chemistry, must be called in at every step to assist the ruder dissections effected by the knife.

With the chemistry of the atmosphere and of water many of the most important problems of hygiene and sanitary science are bound up. Efficient ventilation, or the removal of that portion of the atmosphere which has become chemically altered by respiration or by combustion, and which is consequently no longer fitted for the due support of life, is one of the great objects of the sanitary reformer. It is for this purpose that he widens streets, opens courts, puts in additional windows, and inserts ventilating gratings. It is to prevent the pollution of the air we breathe by the miasmata evolved by decaying animal and vegetable matter, and the spread of pestilence and death, that it becomes necessary to close the cess-pool, and to cause the closet to be properly trapped. It is for this reason that the officer of health insists upon the removal of heaps of ordure, which, when duly returned to the soil, serve as needful manure to stimulate the growth of future plants, and which, by the transforming actions of the chemistry of vegetation, again become fitted to supply food and vigour to the animal creation.

Typhus, diarrhoea, even cholera itself, may often be traced to contamination of the water supply of a district with organic impurity; and in such cases a simple chemical examination of the water has often revealed the acting cause, and thus led at once to the adoption of the appropriate remedy in the introduction of water from a purer source. As illustrations of the direct applications of chemistry to medical practice, I need but remind you of the large and important class of diseases of the kidney and bladder. The different forms of gravel and the varieties of calculous affections can only be successfully treated by carefully watching the changing chemical conditions of the urine and its deposits. In diabetes and albuminaria, it is from the application of chemical tests that the physician obtains the most rapid and certain indications of the progress of the disease and the effects of his remedies.

Few subjects offer more important matter for investigation from a chemical point of view than the various forms of dyspepsia; for there is no function more intimately dependent than digestion upon chemical changes; and yet there are few over which we at present possess less definite control. The manner in which the food becomes converted into a soluble form, suitable not merely for absorption but for assimilation, is, indeed, but little understood; and no greater service could be rendered to practical medicine than a sound interpretation of the physiology of digestion, and of the pathology of dyspepsia; and this we must look for at the hands of the chemical physiologist.

Let me, then, earnestly urge you to the diligent study of the principles of chemistry. In no branch of science is it of more importance to obtain a strong grasp of principles, and in none, from the enormous mass of facts which it embraces, is a judicious selection of the parts to be studied in detail more indispensable. At the same time there is no subject which will by its intrinsic value and interest more amply repay the time and labour bestowed upon its acquisition.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, OCT. 24, 1867.

Preparation of Hydrogen on the large scale—Chemical Manures—The Chemistry of Rotten Eggs—Still another Cure for Cholera.

For the very costly process of the preparation of hydrogen by iron and sulphuric acid, M. Giffard now substitutes the decomposition of steam by incandescent coke. The gas is produced in a sort of furnace charged at the back

with coke, divided by refractory stones at the front into a great number of channels which are traversed by the gas. When the fire is well lighted, the sides of these channels attain a red heat, and the coke is uniformly red throughout its thickness, which is considerable. Then the damper is shut, the ashpit closed, and a jet of steam is made to play on the under surface of the coke. By traversing this mass of coke, the steam is decomposed, producing carbonic oxide, and hydrogen gases.

At the upper part of the boiler there are nine small jets of steam which pass through the carbon and mix with the hydrogen and oxide of carbon as far as the red hot channels, where a new reaction takes place. The carbonic oxide gas is more highly oxygenated at the expense of the steam and is converted into carbonic acid gas, while the hydrogen is set at liberty. The system of tubes is very ingeniously contrived; the tube which unites the two boilers and supplies the four cylinders, is prolonged on the opposite side in case of need. Two tubes, which start from the principle trunk conduct the jets of steam which pass over the coke, and those which traverse it for the production of gas. Two other tubes called blowers, leading to the chimney and the ashpit, assist the combustion by jets of steam. The second produces a reversed draught in order to produce a downward combustion. Lastly, two groups of tubes furnished with and controlled four ways by cocks conduct the steam to two cylinders, the object of which is to open and shut, one the ash-pit door, and the other the damper of the chimney. The gas on quitting the generating furnace is necessarily charged with much steam, and it passes into tubes kept constantly surrounded by cold water, changing continuously, which condenses the greater part of the steam; the water of condensation falls into the bottom of a sort of vertical tubular boiler, transformed into a refrigerator, and is let out by a discharge cock. The gas then passes through a lime purifier, in which it is desiccated before it arrives at the balloon. The purifier is a large case of strong boiler plate, with a man hole at top for introducing the lime, and a grating at the bottom on which the lime rests, and beneath which the gas passes. At a small distance above the grating there are moveable plates revolving on their axes. In the ordinary position in which they are placed, vertically on their edges, the gas enters by interstices similar to those of a Venetian blind. But when the lower part of the lime is exhausted the plates are turned horizontally; they then form a floor on which the unslacked lime rests.

The production of gas is intermittent. When the steam has in part extinguished the coke and cooled the sides of the refractory stone, the admission of the steam is cut off; the ash-pit and damper closed, then one or other of the blowers are set in motion, and the operation of gas-making commences.

M. Georges Ville, the learned professor of the Museum, has rendered to the agricultural world an immense service. In fact, plants which live in the ground and seem to know the best constituents for their well-being, are perhaps the best chemists as far as regards the choice of their elements. M. G. Ville has examined and ascertained, by the aspect even, what elements exist in a sufficient quantity, and what are wanting in the soil to nourish the vegetable.

On the property of M. Payen, at Boncourt (Aisne), there is an experimental plot of ground which is quite perfect in its way, and which has already furnished important results. This piece of ground is laid out similarly to that of Vincennes, where, by the different chemical manures combined by the formulæ of M. Ville, we remark the same ascending scale of crops, from the weakest to the most luxuriant, without the law governing the culture having shown a single exception. Not far from the border of a road, in a flinty land of very bad quality, a plot was manured with 40 tons to the hectare; another parcel of the same ground received a complete manure of 400 kil. of superphosphate of lime, 200 kil. nitrate of potash, 250 kil. sulphate of ammonia, and 350 kil. of sulphate of lime—in all 1,200 kil.—

the cost of which was 325 francs per hectare. Stable dung produced a miserable crop of wheat; the chemical manure gave a splendid return. From a letter addressed to the *Journal de l'Aisne* we learn the following:—

A hectare of sand treated by the complete manure produced—

1. 28 hectolitres of wheat, at 27 francs,	756 f. 0 c.
2. Straw, 6,070 kilos., at 0 f. 4 c.,	242 80
3. Small straw,	4
	1,002 f. 80 c.

The same ground treated with good farm manure, 40 tons per hectare, only produced—

1. 8 hectolitres, 50 litres at 27 francs,	229 f. 50 c.
2. Straw, 1,696 kilos. at 0 f. 4 c.,	67 84
3. Small straw,	1 50
	298 f. 84 c.

M. Al. Donne read a note on rotten eggs, and the manner of action upon the organic products which result from his collection of eggs. The following experiments, the ideas of which have been suggested by M. Balard, respond completely to the conditions of the problem. Old eggs are taken and well shook up so as to mix the yolk with the white; they are plunged into a vase, which is half filled with distilled water; the vase is put then under the receivers of an air-pump. While the vacuum is being made, small air bubbles cover the surface of the egg-shells, penetrating by the pores into the exterior air. The eggs are kept for many hours under the bell-glass without necessarily having a perfect vacuum. When a great portion of the gases of the egg have thus passed, air is let into the bell receiver; the vase is left, and the eggs remain in the water for four hours; the water penetrates into the egg, and by augmentation of weight it sinks deeper in the water; it is then drawn out, wiped, and left alone in an egg-cup. Eggs thus treated decompose and rot most easily; left in a stove at 30° or 35°C. in daylight (which is perhaps essential to the vitality), they exhale at the lapse of eight or fifteen days, perhaps three weeks, a fetid odour; often the same substance exudes through the pores of the shell. In another series of experiments—instead of leaving the eggs in the free air, M. Donne left some in water. In two or three days the water became turbid, and it was peopled with monads and vibrios visible by the microscope. The egg itself was rotten and presented no trace of animation.

M. Poznanski has recently investigated the effects of prussic acid administered in cases of cholera and intermittent fever, in which alteration and carbonisation of the blood takes place. Experiments on dogs and on cholera patients shew that half a drop of pure prussic acid suitably administered is well adapted for the treatment and cure of cholera.

F. MOIGNO.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Nitric Acid in Water.—T. Fuchs determines nitric acid in water by the following method:—Two litres of water are boiled down to about 200 c.c., and during evaporation pure potassic permanganate is added, (the object of which is to convert nitrites into nitrates), until a permanent pink colour is obtained. The concentrated liquid is filtered, pure sulphuric acid added, and distilled into a flask containing baric carbonate suspended in water. The distillation is interrupted when sulphuric acid begins to go over. The contents of the receiver are filtered, and in the filtrate which contains baric nitrate and chloride, the barium is determined in the usual manner. The amount of chlorine being known from a separate experiment, all data are

given for the calculation of the quantity of nitric acid present in the 2,000 c.c. water.

The error caused by the oxidation of ammonia to nitrous and nitric acid the author finds to be inappreciable.—(*Zeitschr. Analyt. Chem.* vi. 175).

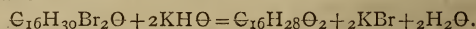
Phosphoric Acid and Nascent Hydrogen.—R. Fresenius. It has been stated by Herapath (*Pharm. Journ.*, vii. 57) that phosphoric acid was reduced by zinc and sulphuric acid, so that hydric phosphide was mixed with the hydrogen evolved. Fresenius tried the experiment, but with a negative result. 100 grammes of zinc were slowly dissolved in diluted sulphuric acid in presence of 10 grammes of sodic phosphate. The gases after passing a small wash-bottle containing water were conducted through two U tubes filled with a neutral solution of argentic nitrate. A small quantity of black precipitate was formed, which on examination was found to contain arsenic and silver, but not a trace of phosphorus in any form. A similar experiment in which no phosphate had been added to the zinc gave the same result exactly.—(*Zeitschr. Analyt. Chem.* vi. 203).

Volumetric Determination of Iron.—A. C. Oudemans. The inaccuracies attached to the method of the direct determination of iron by means of sodic hyposulphite, as first proposed by Scherer, have been removed by the following modification of the process. To a solution of ferric oxide, which may contain much free chlorhydric acid, are added a few drops of a solution of a cupric salt, and potassic sulphocyanide sufficient to render the liquid dark red. A standard solution of sodic hyposulphite is then added until the red colour has entirely disappeared, which point may be observed with great accuracy. The action of the small quantity of cupric salt consists in causing a more rapid deoxidation of the ferric salt.

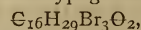
The analysis given in illustration of this method are very satisfactory.—(*Zeitschr. Analyt. Chem.* vi. 129).

Hypogaecic Acid.—K. Schröder. The oil, extracted from the seeds of araneis hypogaea by means of carbonic disulphide, was saponified with sodic hydrate. The soap decomposed with chlorhydric acid, and the mixture of arachidic, oleic, and hypogaecic acid subjected to repeated crystallisations from alcohol, until the last-named acid was obtained in a state of purity.

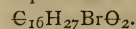
Hypogaecic dibromide, $C_{16}H_{30}Br_2O$, is obtained by the action of bromine on the acid at a low temperature. This bromide, on being treated with alcoholic potassic hydrate at 100°C., is converted into monobromhypogaecic acid, $C_{16}H_{29}BrO_2$; when the reaction is made to take place under pressure and the temperature raised to 170°, palmitic acid, $C_{16}H_{28}O_2$, a lower homologue of stearic acid is formed, the decomposition taking place according to the equation:



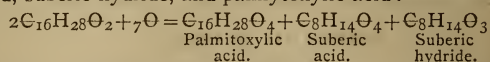
Monobromhypogaecic acid again treated with bromine is converted into monobromhypogaecic dibromide,



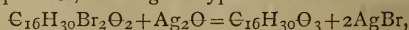
and this when digested with alcoholic potassic hydrate is changed into monobrompalmitic acid,



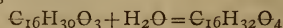
Fuming nitric acid oxidises palmitic acid to suberic acid, suberic hydride, and palmytoxylic acid:



Freshly precipitated argentic oxide and water acting upon hypogaecic dibromide at 100° convert it into oxyhypogaecic acid, and the latter, on being boiled with an alkaline hydrate takes up water, forming dioxyhypogaecic acid:



and oxyhypogaecic acid



dioxyhypogaecic acid.—(*Ann. Chem. Pharm.* cxliii. 22).

NOTICES OF BOOKS.

The Calendar of the Pharmaceutical Society.

PHARMACEUTISTS will find this book of great value as a reference on all matters connected with the Society. In addition to the list of members and associates which was formerly published in the July number of the Journal, it contains the various Acts of Parliament relating to Pharmacy, the regulations of the Board of Examiners, the rules of the Benevolent Fund, and much that will be useful to those interested in Pharmaceutical matters.

CORRESPONDENCE.

DR. CLAUS ON SUCCINIC ACID.

To the Editor of the Chemical News.

SIR,—Permit me a few words in reply to Dr. Claus's communication to your paper of last week.

Dr. Claus wishes it to be understood that I made two unconditional assertions with reference to two particular points noticed in my paper "On some Metamorphoses of Oxalic Acid." I affirm that I did not make these two unconditional assertions. On the contrary, I gave it to be understood that my results as to (1) the existence of an isomer of acetic acid, and (2) the conversion of succinic into butyrlactic acid, were not sufficiently complete to warrant any positive assertion. In the case of the supposed isomer of acetic acid I expressly said—"If the preliminary examination of these substances has conducted me to a correct conclusion, and I am right in supposing the last-mentioned acid to have the formula assigned to it, we have a new isomer of acetic acid." Dr. Claus ingeniously omits the word "and" in his quotation, thus making me say "I am right, &c." I ask you, Mr. Editor, is this omission honest? If it be not a printer's or clerical error, Dr. Claus either does not know the significance in English of such an omission, or he knows it too well.

With reference to butyrlactic acid, I stated my examination of the product in question to be merely qualitative. I certainly intended my remark as to its being premature to express any opinion as to the composition of my products, to apply to the supposed butyrlactic acid. While stating that the properties and salts of the acid I obtained did correspond with those of the true acid, I affirmed nothing concerning its composition, not having submitted it to analysis.

Dr. Claus accuses me of certain omissions in my letter to the *Laboratory*. My letter, which you quote, contained naturally those paragraphs only of my original paper which showed the reservation I had felt it necessary to make: fuller extracts would have been out of place; nor have I newly expressed any opinion as to the correctness of my original results and anticipations. I will indeed acknowledge freely any errors I may have committed.

I hardly care to refer to the uncourteous tone of Dr. Claus's letter, or its offensive innuendoes. What occasion can Dr. Claus have for telling your readers that he promises never more to quote any of Mr. Church's communications or to believe them? Does he wish me to say how deeply such a terrible threat grieves me, and that I have in consequence no longer any incentive to chemical work?

Dr. Claus supposes that I never thought my answer would come into his hands. Is not this supposition perfectly gratuitous? On what shadow of foundation does it rest? It is not only gratuitous but foolish. Dr. Claus says, moreover, that I have denied my own words. He says this, but his attempts to prove it will I am sure be generally considered ineffectual. I have quoted my own words, not denied them.

But it is not worth while to argue concerning these matters with a disputant who descends to offensive personalities. If his position were a strong one he would not need them: a weak position they will not avail to strengthen.—I am, &c.,

A. H. CHURCH.

Cirencester, October 21, 1867.

VOLATILITY OF SESQUICHLORIDE OF IRON.

To the Editor of the Chemical News.

SIR,—After reading Mr. Skey's note on the volatility of sesquichloride of iron at common temperatures, given in last week's CHEMICAL NEWS, I tried some experiments upon the subject. Without at present in any way disputing the fact, I would draw the attention of this gentleman to a possible source of error. In my experiments I found that the vapour from pure hydrochloric acid caused a faint tint in an aqueous solution of the ordinary crystals of sulphocyanide of potassium.

M. Stas states that hydrochloric acid evaporated in an open vessel becomes contaminated with impurities; and an examination made by myself has shown the presence of iron in the light particles of dust deposited on the upper shelves of lofty rooms. It may be safely stated, then, that minute particles of iron are continually floating about in the atmosphere.

Now, considering the great delicacy of the test, and the excessively small quantity of iron necessary to effect colouration in a solution of an alkaline sulphocyanide, it must surely be difficult to prepare on a manufacturing scale crystallised sulphocyanides which will not give a faint pink tint by contact with hydrochloric acid.—I am, &c.,

HENRY SEWARD.

CHEMICAL PATENTS.

To the Editor of the Chemical News.

SIR,—I write for information, or, at all events, to throw some light upon a critical expression of yours, which under slight modification is not uncommonly to be met with in the pages of the CHEMICAL NEWS. To quote an instance of this remark in illustration,—I may state that having been recently engaged in a controversial dispute, in another journal, as to the originality of a certain invention for producing chlorine, and my opponent having referred in condemnatory terms and for reasons of his own to a totally different patent of mine, viz., "for improvements in the manufacture of inflammable gases," he makes an extract in support of his views from the columns of some *un-named* authority; but having already seen the remark myself, I know that authority to be the CHEMICAL NEWS. The extract referred to is the following:—You say, speaking of my patent—"This is another case of patenting well known chemical processes." Now, Sir, having already stated that I seek for information, will you be so kind as to furnish me and your readers generally with other than a very exceptional list of chemical patents which are not founded on well-known chemical processes? Take for instance Howard's or Scoffern's patents for refining sugar. The remarkable power possessed in so high a degree by animal charcoal of absorbing colouring matters, as well as the coagulative property of serous albumen when heated beyond 140°F., were facts I apprehend as thoroughly known as was the abstract physical principle of the vacuum pan prior to the date of the first of these patents; as was also the depurative power of acetate of lead, anterior to the date of the second patent. Again, and taking at random another invention out of many. In "Brankart's Patent Copper Smelting Process,"—the chemical facts upon which this patent rests were thoroughly well known before they were applied to this specific purpose by the inventor. Was it not known

that sulphide of copper roasted under certain conditions would produce sulphate of copper, and that such sulphate of copper, when dissolved, would by the superior affinity of iron throw down the copper in a metallic state, and by the appropriation of the negative elements present produce sulphate of iron or coppers? Take another instance. Mr. Gill a few years since invented a lamp without flame in which a cylindrical coil of platinum wire, the hundredth part of an inch in diameter, and making about ten turns, was maintained in a state of incandescence by the vapour of alcohol. The chemical principle here was also old, having been discovered years before by Sir Humphry Davy. I do not suppose I have selected the happiest illustrations of the application of known chemical principles to useful purposes, but they will at least serve to prove my position, namely, that in innumerable instances, what are called chemical inventions, and are recognised by the law to be legally such in the abstract, and therefore sound and patentable, are all more or less so many other cases of patenting well known chemical processes. It is true that instances may be occasionally brought forward where a chemical or physical *discovery* is recorded for the first time in the specification of a patent, securing its *application* to some useful purpose; but this is the exception to the rule, and not the rule itself.

And again, it occasionally occurs that a chemical principle is so well known in its application to any particular purpose that a patent will only hold good by claiming certain specific machinery or apparatus as applied thereto. Where, however, such is not the case, where a useful and economical result is obtained by combining several separate but well known chemical principles together, in consecutive order, so as to constitute what may be termed a circle of affinities, and to lead to important manufacturing results not hitherto obtained,—then I think the judgment of the general reader should not be warped, the co-operative power of capital suspended, nor the criticism of the malicious invited. First, by sweeping the bulk of chemical patents into one condemnatory sentence, and saying of each in succession as it appears—"This is only another case of patenting well known chemical processes"—as though there were really no novelty whatever in the case, either as to *method* of operation or useful *results*.

The reason that induces me to speak is that such remarks are calculated to do considerable injury, and rests, as it appears to me, on no solid or legal foundation.—I am, &c.,

ISHAM BAGGS.

54, Chancery Lane.

OZONE.

To the Editor of the Chemical News.

SIR,—The following is an account of the development of ozone during July, August, and September:—

In July there were periods with very little ozone from the 1st to the morn. of the 3rd, from the 5th to the morn. of the 13th, on the aft. of the 16th, morn. of the 18th, from the 19th to the 21st, from the aft. of the 23rd to the 28th, and on the afts. of the 29th, 30th, and 31st. Considerable quantities of ozone were present on the aft. of the 13th, and from the 22nd to the morn. of the 3rd. Large amounts on the aft. of the 3rd and morn. of the 4th, from the 14th to the morn. of the 16th, on the 17th and aft. of the 18th, and on the morns. of the 29th, 30th, and 31st.

In August there were periods with very little ozone from the 4th to the morn. of the 5th, aft. of 7th, aft. of 9th to 11th, 15th, aft. of 19th and morn. of 20th, and from the 26th to the 31st. Considerable amounts on the morns. of the 8th and on the 21st. Large amounts on on aft. of the 5th, on the morns. of the 6th, 7th, and 9th, the 14th, 17th, morns. of 18th, 19th, and aft. of 20th. There was a period of variable development from the 22nd to the 25th. In September there were periods with

very little ozone from the 1st to the morn. of the 2nd, on the 3rd, morn. of the 8th, from the 9th to the 11th, aft. of 12th to morn. of 14th, 15th to morn. of 17th, from the aft. of the 19th to morn. of 21st, on the aft. of 22nd and morn. of 23rd, morn. of 24th, and from the 25th to the 28th. Considerable quantities on the morn. of 12th, morn. of 19th, aft. of 24th, and aft. of 30th. Large amounts aft. of 2nd, 4th to morn. of 7th, aft. of 8th, aft. of 14th, aft. of 17th, to 18th, aft. of 21st and morn. of 22nd and 29th to morn. of 30th.—I am, &c.,

R. C. C. LIPPINCOTT.

Bournemouth.

RECOVERY OF SULPHUR FROM ALKALI WASTE.

To the Editor of the Chemical News.

SIR,—In your impression of 26th of July, 1867, in an article on the recovery of sulphur from alkali waste, by Ludwig Mond, that gentleman says "the most successful of them has probably been that of Mr. Benjamin Jones, a workman who assisted me in working my process out on a large scale in 1863, at the works of Messrs. Hutchinson and Co., Widnes. One of the three patents which he took out between December, 1863, and May, 1864, has been worked a short time in Warrington, but was, however, quickly abandoned."

Now, Mr. Mond must have been conscious at the time of writing the above, that I was not working at Messrs. Hutchinson's at the time to which he alludes, and I may add that I only know Mr. Mond by report, never having either seen or spoken to him, to the best of my knowledge.

It is true that my patent was worked for some time at Warrington, but the reason of its discontinuance was not through inefficiency of the process. I shall esteem it a favour if you will kindly insert this in your next impression.—I am, &c.,

BENJAMIN JONES.

Castle Hill, Hindley, near Wigan Lancashire, October 19, 1867.

MISCELLANEOUS.

Composition and Quality of the Metropolitan Waters in September, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Water Companies.	Total solid matter per gallon.	Loss by Ignition *.	Oxidisable organic matter †.	Hardness.		Organic and other ammonia.
				Before boiling.	After boiling.	
	Grains.	Grns.	Grains.	Degs.	Degs.	Grains.
<i>Thames Water Companies.</i>						
Grand Junction	17'80	1'15	0'56	13'0	4'0	0'001
West Middlesex	17'47	1'50	0'52	12'5	4'0	0'003
Southwark and Vauxhall	17'93	1'55	0'78	12'5	3'5	0'007
Chelsea	19'33	1'50	0'93	13'5	3'5	0'003
Lambeth	18'50	1'95	0'72	13'5	4'0	0'003
<i>Other Companies.</i>						
Kent	27'00	1'55	0'24	19'0	7'0	0'000
New River	14'73	1'40	0'28	12'5	4'0	0'002
East London	17'91	1'60	0'48	12'5	4'0	0'003

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

Preservation of Stone.—This subject, which has attracted the attention of so many chemists, seems now to have been brought to a very successful point. We have received some specimens of chalk treated by a process discovered by Messrs. Dent and Brown, of the Chemical Department, Woolwich. Their process consists in the application of a solution of oxalate of alumina to the stone. The experiments date from December, 1865, and the results they have now obtained are most encouraging. The process is applicable to limestone, dolomite, and chalk, and may, we think, be made subservient to the preparation of lithographic stones. Oxalate of alumina is readily soluble in water, and the solution, which is simply applied with a brush, is made of a strength varying with the porosity of the material to which it is to be applied. The specimens we have before us are left in the original condition at one end, and have been prepared with the solution at the other. The physical characteristics of chalk so treated are—lightness, the possession of a glazed surface approaching somewhat in appearance marble, and greatly increases hardness; in this respect the stone is about equal to Fluor spar, or 4 in Mohs' scale. Furthermore, the lime being transformed into one of the most insoluble and unalterable of its compounds, and the alumina being precipitated, the pores are filled with a substance almost unacted upon by water or by the impurities present in the atmosphere of large cities. We should be glad to hear that the discoverers had one of the experimental bays of the Houses of Parliament placed at their disposal. They might thus prove their process to be a formidable rival to that of their colleague Mr. Spiller, which according to present appearances is likely to be the most successful of all the numerous schemes now *sub judice* at Westminster.

Sulphocyanide of Chromium.—When a mixture of bichromate of potash and sulphocyanide of potassium is treated with hydrochloric acid, the liquid acquires a reddish purple color, and on agitating it with ether, a red sulphocyanide of chromium is dissolved thereby, while the aqueous solution acquires a pure green colour. If the action of the sulphocyanide is further prolonged, the original purple red colour passes into green, and ether refuses to extract any of the chromium. It has since been found that by using a limited quantity of the sulphocyanide only the red colour is produced, and ether then extracts the whole of the chromium salt. From these circumstances it appears likely that the pleochroism exhibited by the solutions of various chromium salts is due to the presence of two different oxides of chromium, the green sesquioxide and a higher oxide. A double sulphocyanide of potassium and chromium appears to form when a solution of bichromate of potash is evaporated at a very gentle heat, with a small quantity of a sulphocyanide in hydrochloric acid. It falls in granular ruby coloured crystals.—*William Skey, New Zealand.*

Impermeable Oil Barrels.—The Titusville, Pa., *Herald* describes the process for rendering casks or barrels airtight and impermeable to oil, spirits, turpentine, and all volatile fluid, that has been in operation in its vicinity for a year, with such good results. The barrel having passed from the finishing hands of the workmen, the process of permeating is in this wise. The barrel is placed over tubes through which hot air is injected into it for twenty-four hours, thoroughly heating the wood and opening the pores. Any worker in wood knows that glue will not stick to a cold surface as well as to a warm one, and this fact is a serious inconvenience in the old fashion of glueing barrels by hand. From these tubes the barrel is placed in a framework that braces the head, and allows it to revolve on either axis. Hot glue is poured into it, and distributed over every portion of the inner surface. A tube is then introduced through the bung hole, and a pressure of twenty

pounds of air to the square inch applied, forcing the glue into every crack and crevice and even the pores of the wood; so great is the pressure that the glue is often forced through the pores to the outside of the barrel. The package is then impermeable and as tight as a bottle.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2505. F. H. Pattison, and J. W. H. Pattison, Glasgow, N. B., "A new or improved metal-founders' blacking." Petition recorded.—September 4, 1867.

2571. W. Baker, Tipton, Staffordshire, "Improvements in the manufacture of iron, and in furnaces used in the manufacture of iron."

2577. H. R. Lückes, Coleford, Gloucestershire, "The manufacture of artificial or compressed fuel in the treatment of coal, peat, charcoal, tan, sawdust, and woody fibre, whereby those substances, either together or separate, can be utilized when in a state of powder or minute division, and converted into a serviceable fuel."—September 11, 1867.

2608. P. Dumont, Stoke Newington Road, Middlesex, "An improved manufacture of soap."—A communication from A. L. Labather, A. Bizet, and L. F. J. Lecat, Place Saint Jacques, Compeigne, France."—September 16, 1867.

2611. C. Fiolste, Henrietta Street, Covent Garden, Middlesex, "Improvements in blast furnaces."—A communication from F. Lürmann, Oesede, near Osnabrück, Prussia.—September 17, 1867.

2637. J. G. Willan, Saint Stephen's Crescent, Baywater, Middlesex, "Improvements in the manufacture of iron."—September 19, 1867.

2679. V. V. Beardmore, W. Brock, and A. C. Kirk, Glasgow, N. B., "Improvements relating to furnaces."

2685. A. Ziegele, Mincing Lane, London, "Improvements in the manufacture of Epsom salts."—A communication from Messrs. Vorster and Grüneberg, Cologne, Prussia.—September 23, 1867.

2711. R. W. Bennie, Glasgow, N. B., "Improvements in the manufacture of moulders' blackening."

2711. J. Fordred, Blackheath, Kent, "Improvements in bleaching and purifying paraffin."—September 26, 1867.

2711. L. de la Peyrouse, Somerset Street, Portman Square, Middlesex, "Improvements in the treatment of paraffin, fatty, and resinous matters."—A communication from L. Krafft, Rue de L'Eglise, Neuilly, near Paris.—September 27, 1867.

2756. E. P. Alexander, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of cast steel, and in furnaces to be employed therein."—A communication from F. Ellershausen, Ottawa, Canada.

2760. G. Allibon, Worcester, and A. Manbré, Baker Street, Middlesex, "Improvements in apparatus applicable to the conversion of mineral and vegetable substances into saccharine matter, in treating and purifying saccharine substances extracted from malt, fruits, and vegetable matters, in treating fatty matters, and in the manufacture of chemical products."—October 1, 1867.

2712. H. D. Pochin, Salford, Lancashire, and E. Hunt, Manchester, "An improvement in the construction of furnaces, flues, and vessels which are subjected to high temperature."—October 3, 1867.

2801. J. Anderson, Londonderry, Ireland, "Improvements in obtaining chlorine, sodium, potassium, phosphorus, and their compounds."—October 6, 1867.

2816. C. D. Abel, Southampton Buildings, Chancery Lane, "A new or improved process and apparatus for refining camphor."—A communication from C. E. Perret, Boulevard de Strasbourg, Paris.

2817. D. Swan, jun., Mary-hill, Lanarkshire, N. B., "Improvements in the manufacture of zinc."

2822. J. H. Brown, Romsey, Hants, "Improvements in utilising refuse animal matters, and producing skins and sheets therefrom."—October 7, 1867.

NOTICES TO PROCEED.

1646. E. Meldrum, Bathgate, Linlithgow, N. B., "Improvements in the purification of paraffin."—Petition recorded June 4, 1867.

1652. V. N. Rausch and E. L. Darlet, Brussels, "Improvements in the manufacture of artificial fuel."—June 5, 1867.

1752. V. V. E. Newton, Chancery Lane, "Improvements in the preparation of pulp for the manufacture of paper."—A communication from A. A. Ussetot, Rue St. Sebastian, Paris.—June 15, 1867.

2102. C. Klug, Regent Street, W., "An improvement in the preparation of chocolate and cocoa."—July 17, 1867.

2395. C. W. Siemens, Great George Street, Westminster, "Improvements in furnaces, and in processes and apparatus in connection therewith, principally applicable to metallurgical operations."—August 21, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Dingler's Polytechnisches Journal.
June.

J. P. REININGHAUS, "An Apparatus for Measuring and Regulating the Supply of Fluids." G. BISCHOF, JUN., "On the Colorimetric Estimation of Copper." C. THIEL, "On the Preparation of Meat Biscuits." C. SIMEONS, "On the Manufacture of Articles in Mica by M. Raphael, of Breslau."

June.

C. KUHN, "On Pouillet's Method of Applying Lightning Conductors to Powder Magazines." G. LUNGE, "Notes on Technical Chemistry: 5. On the Manufacture of Bone Black, Sulphide of Ammonium and Super-phosphate of Lime." R. BRIMMEYER, "Notes on Technical Chemistry: 5. On the Decolorising power of Bone Black." 6. On the Aniline Dyes at the French Exhibition." R. WAGNER, "On the Detection of Woollen Fibres in Silk Yarn and Fabrics."

L'Invention.
July.

POIRRIER AND CHAPPAT, "On a Method of Manufacturing Dyes by the Action of Alcohols on Aniline." HOLLIDAY, "A new Process for producing Red and Violet Aniline Colours." DANGEVILLE AND GAUTIN, "A process for discharging Aniline Colours from Fabrics." QUENEAU, "On the Use of Crude Limestone for disinfecting Beet Juice." JUNEMANN, DU RIEUX, AND ROETGER, "On the Extraction of Sugar from Saccharine Solutions by means of Lime." HEURTEISE, "On an Economical Process for producing Hydrogen Gas by Heating Carbonic Oxide in Contact with Superheated Steam."

Génie Industriel.
July.

E. FIEVET, "On Measuring Temperatures." SCHINZ, "An Improved Pyrometer."

Comptes Rendus.
August 5, 1867.

FAYE, "On the Influence of External Causes on the Formation of Sun Spots." H. TARGIONI-TOZZETTI, "On the Wax of *Coccus carica*." V. POULET, "On the Presence of Infusoria in the Breath of Persons suffering from Whooping Cough."

August 12.

SIR DAVID BREWSTER, "On the Authenticity of the Newton and Pascal Correspondence." CHARLES, "On the Authenticity of the Newton and Pascal Correspondence." DUHAMEL, "On the Authenticity of the Newton and Pascal Correspondence." E. HOPKINS, "On a Method of destroying the Magnetic Polarity of Iron Ships." WOLF AND RAYET, "On the Spectra of Three Stars in the constellation Cygnus." P. VOLPICELLI, "On the Correlations of Galvanometers and of Gauss' and Lamont's Methods of Calculating the Horizontal Intensity of the Earth's Magnetism."

Monatsbericht der Königlich-Preussischen Akademie der Wissenschaften zu Berlin.
May, 1867.

W. FORSTER, "On the Influence of the Density of the Air on the Rate of a Clock, especially on the normal Clock of the Berlin Observatory, and on the Performance, when enclosed in an Air-tight Case, of an Electro-magnetic Clock made by F. Tiede." POGENDORFF, "On the Development of Heat in the Path of the Electric Spark."

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien. (Mathematisch-naturwissenschaftliche Classe).
February, 1867.

S. STRICKER, "Researches on the Vitality of the Colourless Blood Corpuscles in Man." F. ROCHLEDER, "Note on the Constituents of the Root Bark of the Apple Tree." J. F. SCHMIDT, "On the Recent Changes in the Crater of *Linnaeus*."

Sitzungsberichte der Königlich-Bayerischen Akademie der Wissenschaften (Mathematisch-physikalische Classe).
January 12, 1867.

VOGEL, JUN., "On Washing, Pressing, and Preparing Peat." VON GORUP-BESANEZ, "On Pyrocatechine, a product of the Action of Iodine and Phosphorus on the Rhenish Beech Wood Tar Creosote."

Poggendorff's Annalen der Physik.
No. 5, 1867.

H. KNOBLAUCH, "On the Interference Colours of Radiant Heat." L. PFAUNDLER, "Contributions to Chemical Statics; Attempt to explain the Phenomena of Dissociation and Affinity according to a new Theory." J. PHILLIPP, "On the Action of Sulpho-cyanide of Potassium on the Salts of Mercuric." E. J. COMMEL, "On the Cause of the redness of the Sky in the Evening, and Phenomena in connection therewith." A. HAAGEN, "A Determination of the Refractive Index and Specific Gravity of some Liquid Compounds: Tetrachloride of Carbon, Chloroform, Chloride of Ethylene, Bromide of Ethyl Bromide of Amyl Bromide of Ethylene, Iodide of Methyl, Iodide of Ethyl, Iodide of Amyl, Bromide of Carbon, Chloride of Sulphur. Trichloride of Phosphorus, Trichloride of Arsenic, Pentachloride of Antimony, Chloride of Zinc, Chloride of

Silicium, and Chloride of Sodium, à propos of the Question of the Refractive Equivalent of the Elements." E. SCHOENE, "Note on Crystallised Hydrate of Potassium." P. RIESS, "On the Cause of the Undulations produced in Metallic Wires by the Electric Discharge." G. QUINCKE, "Remarks on L. Daniel's Paper, published in the *Comptes Rendus* of May 11, 1867, on the Transport of Matter by the Voltaic Current." KINDT, "On the Spectrum of the Phosphorescent Light of Phosphorite, Chlorophane, and other Varieties of Fluor Spar."

NOTES AND QUERIES.

Gun Cotton.—Can any of your readers inform me what works have been published upon the new explosives, nitro-glycerine, gun-cotton, and Scheeltzes wood gunpowder, and if any and what chemical authorities have reported upon them?—K.

Transparency of Red Hot Metals.—Sir,—I noticed a short time since, in one of the numbers of the CHEMICAL NEWS, some letters on the transparency of red hot metals. A few weeks ago, I went over some steel works in the North of England, and there the manager spoke of it as a well-known fact that steel at a white heat was transparent. In proof of it he showed that, when the molten metal was being poured out, the edge of the crucible appeared to be distinctly visible through the molten metal. This could only be seen directly the crucible was taken out of the furnace, before it had cooled in the least. If the metal is not transparent will any of your correspondents say whether this appearance can be accounted for in any other way?—EXON.

Bleaching Palm Oil.—Sir,—Would you oblige me by giving me some information through the medium of your Notes and Queries column in reference to "Bleaching Palm Oil." I am connected with a works at which palm oil is used, and occasionally it is required to be bleached. I have applied myself to the task of bleaching it with only indifferent success; I follow (as I believe) the method once patented by Mr. Watt. I first introduce the orange coloured oil into a tub open at the top into which an open steam jet is conducted, I allow the steam to blow into it until its temperature marks 130 deg. or 134 deg. F. I then add to the oil a saturated aqueous solution of 1 lb. commercial "Bichrome" for each cwt. of oil to be operated upon, as nearly the same temperature as the oil as possible. I then add a quantity of hydrochloric acid (commercial) equal in weight, as nearly as I can guess, to double the weight of bichrome before being dissolved. I then agitate the mixture with a paddle, and the characteristic odour of nascent oxygen is quickly perceptible, which continues to emanate for 1½ or 2 hours without decolorising the oil to any sensible extent, the agitation being kept up the whole of the time. Parnell describes this process as requiring only five minutes for decolorising the oil. I must therefore be more egregiously at fault, for even after the expense of so much labour the product is not at all satisfactory. I have even employed double the quantity of the bleaching agents with no better success.—GEO. JOHNSON.

TO CORRESPONDENTS.

Enquirer.—The report has been long out of print.

F.—A letter will be sent if you leave the address at our office.

Theta.—Hayesite is another name for Boronatrocalcite.

J. H. Salis.—Send particulars, and our printer will give you an estimate for printing the pamphlet.

S.A.Y.—No process is yet known for the quantitative separation of the two metals.

Distiller (O. J. Q.)—Bisulphide of Carbon has been found in many specimens of American Petroleum. The portion distilling below 80 degs. C. contains nearly all.

James Peterson.—Artificial lithographic stones have been made in France, but we know not with what success. Their manufacture should not present any insuperable difficulty. All would depend on the demand, and price willing to be paid. Send a specimen of what you have produced.

F. Garland.—You will probably find a paste made of starch, glycerin, and plaster of Paris, answer your requirements. It will retain its plasticity and adhesiveness longer than most other cements.

W. O. Lever.—The impurity has got into your test solution from the glass bottle in which it has been kept. This is a far more frequent source of impurity in reagents than many chemists would imagine.

Books Received.—"The Nation" for October 10, 1867. "The CHEMICAL NEWS," American Reprint, Vol. 1. No. 4, for October 1867. "Silliman's American Journal of Science" for Sept. 1867. "The Standard" for October 21 and 22.

Communications have been received from W. Chapman; J. Johnson; Professor Gustavus Hinrichs (with enclosure); W. Y. Dent; Miss Becker (with enclosure); W. A. Townsend and Adams; J. Seeley (with enclosure); Professor A. H. Church (with enclosure); D. Forbes, F.R.S. (with enclosure); Dr. W. A. Miller F.R.S.; Henry Seward; J. D. Munro; W. Mackie; William Rogers (with enclosure); A. Francis; W. Hickman; J. Jolley; E. Delafield; W. Thomas (with enclosure); Rev. B. W. Gibbons; John Parnell (with parcel); Mr. Thorne; R. Campbell, jun., Canada; "Enquirer"; W. Sugg; C. Mullingbach (Hanover); Arthur Warner; C. R. Wright (with enclosure); H. Greenwood (with enclosure); Alment and Johnson (with enclosure); W. Preece (with enclosure); Bailey and Son (with enclosure).

THE CHEMICAL NEWS.

VOL. XVI., No. 413.

ON THE MANUFACTURE OF SALTPETRE.

By J. H. SWINDELLS.

I have lately examined several lots of refuse (muriate of soda, &c.) from various saltpetre makers, and find a serious loss of potash and other materials. The refuse from saltpetre works is mostly sold for manure, either alone or mixed with other substances. From the analysis I give below it will be seen that this refuse in many cases contains a large amount of potash, &c., thus showing bad and careless working.

Analysis of muriate of soda.

Muriate of soda,	70.50
Muriate of potash,	8.81
Nitrate of potash,	6.15

The rest was made up of sulphate of lime, insoluble matter, and water. Another sample showed very near working; it gave me

Muriate of soda,	97.13
Nitrate of soda,	1.10

Insoluble matter, sulphate of lime, &c., formed the remainder.

Twelve samples of refuse gave me an average of 5.6 per cent of potash lost in working. Several samples gave me a large amount of insoluble matter, owing, I should imagine, to the "sweeping up" of the factory and to the muriate of potash, which in many cases I know contains a larger amount of foreign matter than it ought to do, although it is sold, generally speaking, with a guarantee that it contains "80 per cent."

I will now give a short account of the method generally followed in the manufacture, and a recommendation of my own to prevent loss of materials. In all the manufactories I have been able to visit the process was as follows:—A certain weight of muriate of potash and nitrate of soda was put into an iron pan along with a quantity of water. The steam was then blown into the "mixture," which is stirred about till such time as it is thought the muriate and nitrate are dissolved. The liquid is then run or syphoned into a tank, and after a certain time the resulting crystals are removed, and invariably refined. The last process is simply done by dissolving down the crystals and re-crystallising. I found that no hydrometers were used for ascertaining the density of the liquids, but that everything was done on the "guess" principle. By following this process a loss will always occur; for how is it possible to tell when all the materials have thoroughly dissolved? Moreover, it takes a longer time to dissolve the materials together than it would occupy if the muriate and nitrate were dissolved separately.

The chemical action is too well known to be described here; I will, therefore, proceed to consider the best way of preventing any loss of materials. I would recommend that the muriate of potash should be dissolved in as little water as possible; then dissolve the nitrate of soda also in as little water as may be convenient, add the two solutions together and boil for one hour or so. This will precipitate a portion of the muriate of soda, which may be "fished" out of the pan, the liquid will now be found to have a specific gravity of about 1.200, 1.250, or 1.275, according to the manner in which the "dissolving and boiling" down is conducted. The liquid, after remaining at rest 2 hours or so, may be run into the coolers in the usual way to allow the nitrate of potash to crystallize out of the liquor; of course all the nitrate of potash

does not crystallize out. A quantity remains in the "mother liquor," a portion of which may be used for dissolving the raw materials. The mother liquor, however, should not be too strong, as neither the muriate nor nitrate dissolve well in strong mother liquor; about 15 Twaddell will be found about the strength. When the "mothers" begin to increase and become too many for "dissolving" purposes, they must be salted down and crystallized. This is done by placing them in an evaporating pan, and boiling them down to about 35°, or so, Twaddell; care must be taken to remove the muriate of soda as it falls to the bottom of the pan. This may be done by means of perforated ladles. There is sure to be a little nitrate of potash clinging to the muriate of soda, and the manner of separating this must be considered. Even when there is so much as 5 per cent of potash mixed with the muriate of soda, it will scarcely pay to extract it, unless coals are very cheap; for the entire mass would have to be dissolved, and the liquor evaporated down to the crystallizing point. I would recommend the following plan:—As the muriate of soda is taken out of the pans it should be placed in a strong tub with a kind of filter bottom—this tub to be provided with a tight fitting top, through which a pipe passes for the admittance of steam. After the muriate of soda has been put in this tub and the top secured, the steam is blown through the mass for 15 minutes, and the liquor run off by means of a tap placed at the bottom of the tub. This liquor may be used for dissolving the raw material, and all over and above that required for this purpose must be evaporated down along with the mother liquor. By all means, the manufacturer, if he is not capable of making his own analyses, should have analyses made from time to time of his muriate of soda; he will then be able to form the best opinion of what he is doing, and thus avoid any unnecessary loss. Owing to the low price of saltpetre, very close working is required to make the business pay, and adulteration is coming much into vogue. The adulteration is practised by the manufacturer, and the saltpetre also meets with sophistication after it leaves his hands. The most glaring adulteration is common salt and alum. The muriate of soda from saltpetre making, is cleansed and mixed in the proportion of 2 cwt. to the ton of petre. In the process of refining the saltpetre, from 2 to 3 cwt. of alum is sometimes used. Nitrate of potash adulterated like this will not of course do for the gunpowder makers, but for many other purposes this adulteration often passes unnoticed.

ON SESQUISULPHATE OF IRON AND FERRID-CYANIDE OF POTASSIUM AS A TEST.

By EDWIN SMITH, M.A.

HAVING occasion to explain to my class the deoxidizing property of sulphurous acid, it occurred to me that the property in question might be illustrated by exposing a slip of bibulous paper, dipped in a mixed solution of sesquisulphate of iron and ferridcyanide of potassium, to the vapour rising from a bit of sulphur burning in air. For should the persalt of iron be reduced to a protosalt by giving up an equivalent of oxygen to the sulphurous acid, a blue reaction ought to take place with the ferridcyanide of potassium present in the solution. I tried the experiment, and the colour of the paper was instantly changed to a beautiful blue. A solution of sulphurous acid, or of a sulphite or hyposulphite, gives the same result; while only a very slight greenish tinge is imparted to the mixture by a sulphate, except in the case of protosulphate of iron. With this exception, a useful test seems to be afforded between sulphites and sulphates. I find the same test will discriminate a nitrite from a nitrate. To the mixed solution of sesquisulphate of iron and ferridcyanide of potassium

add a few drops of nitric acid; then add a little of the solution to be tested. If the latter contains a nitrite, a greenish blue precipitate will begin to fall, and quickly increase; if a nitrate, only a slight greenish tinge will be imparted to the test. Nitric oxide or nitric trioxide passed into the mixed solution throws down the same characteristic precipitate, which is produced by the decomposition of a nitrite in the previous case. Carbonic oxide will act in the same way, and if a slip of paper dipped in the test-mixture be held over the clear part of a bright coal fire, it turns blue with the carbonic oxide or sulphurous acid there given off. Again, if a bit of phosphorus is dropped into a little of the test in a porcelain dish, the phosphorus immediately becomes coloured a greenish blue, and on stirring about, gradually imparts the same tinge to the solution. Phosphorous acid may be discriminated from phosphoric acid, just as sulphurous acid was distinguished from sulphuric acid, by the blue reaction with our test. Thus also phosphites are distinguished from phosphates. A solution of phosphorous acid showed the reaction readily on being shaken up with the test. Lastly, if copper turnings are boiled in the latter for a few minutes, a greenish blue tint is imparted to it, which becomes gradually deeper with the oxidation of the copper and the consequent reduction of the persalt of iron to the state of a protosalt.

ON A
COMPOUND FORMED BY THE DIRECT UNION
OF
ALDEHYDE AND ANHYDROUS PRUSSIC ACID.

By MAXWELL SIMPSON, M.D., F.R.S., and A. GAUTIER, M.D.

THE synthesis of alanin from aldehydate of ammonia, prussic and hydrochloric acids, and the formation of lactic acid by the action of the same acids upon aldehyde in presence of water, render it highly probable that an intermediate body exists, resulting from the direct combination of hydrocyanic acid and aldehyde. It is this body which forms the subject of the present memoir.

If one molecule of anhydrous prussic acid is added to one molecule of dry aldehyde, contained in a matrass surrounded with a freezing mixture, the two liquids mix without combining chemically, and their chemical combination is not accelerated by heating at 100° C. If, however, we leave them in contact for ten or twelve days, at the ordinary temperature of the air, they gradually unite, forming a perfectly transparent and colourless liquid. On subjecting this to distillation it was observed that hardly a drop passed over at 100°, although we operated upon a large quantity of liquid (34 grms.), a small quantity between 160° and 174°, and the remainder of the liquid between 174° and 185° C. On re-distilling the latter portion, in order to fractionate it, it was found that the greater part passed over at about 183° C. Notable quantities of the liquid, however, came over between 40° and 60° C., consisting principally of the parent bodies which had been dissociated by the simple vaporisation of the liquid. On leaving these bodies thus disassociated once more in contact for some days the point of ebullition rose, as before, to 183° C. The fractions boiling at 180°, and between 183° and 184° C. gave, on analysis, the following results:—

Product boiling at 180° C.	Product boiling between 183°-184°.	Theory.
C 49.78	51.70	CNH ₂ C ₂ H ₄ .
H 7.44	7.64	50.71
N 20.42	„	7.04
		19.83

These analyses prove that the body in question results from the direct combination of one molecule of aldehyde

and one molecule of anhydrous prussic acid, or at least of equal numbers of molecules of these bodies, and that its point of ebullition is intermediate between 180° and 184°. We have tried the above experiments on mixtures containing the two generating bodies in various proportions, but always with the production of the same body. The name we propose for this compound is cyanhydrate of aldehyde, which is simply founded upon its synthetical formation.

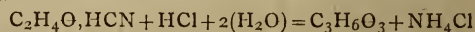
Properties.—The cyanhydrate of aldehyde is a colourless liquid, having a faint odour of its generators; it has a bitter and acid taste; it does not crystallise at 21° C., but becomes syrupy. It can bear the temperature of 150° for a considerable time without suffering decomposition; at 180°, however, slight dissociation commences, and the liquid must be rapidly distilled in order to avoid the loss of a considerable quantity. It is soluble in all proportions in water and alcohol. It may be heated with water in a sealed tube to 150° C. without suffering the slightest decomposition, and the entire liquid can be recovered by distillation. Caustic potash appears to separate it into its two generators, forming cyanide of potassium and resin of aldehyde. A little ammonia is also evolved, owing, probably, to the decomposition of the cyanide of potassium.

Gaseous ammonia is absorbed by this body, with the production of a base, which gives a precipitate with bichloride of platinum. Our analyses of this salt have not yet enabled us to ascertain the composition of the base.

A strong solution of hydrochloric acid acts with great violence at the ordinary temperature of the air upon cyanhydrate of aldehyde. If, however, the cyanhydrate is introduced into a balloon surrounded with a freezing mixture, and the hydrochloric acid added gradually, the two liquids mix without any reaction taking place. On removing the open balloon from the freezing mixture, and placing it in water at the ordinary temperature, the reaction soon commences, and proceeds gradually till the entire liquid becomes a mass of crystals. These were twice treated with absolute alcohol, and the alcoholic solution evaporated, in order to separate the chloride of ammonium which is formed. A syrupy liquid was thus obtained, which was saturated at 100° C. with pure oxide of zinc and filtered. The filtered liquor gave, on cooling, a mass of beautiful prismatic crystals. These were recrystallised, heated in an oil-bath to 150° C., and analysed. The numbers obtained prove that the body in question was the lactate of zinc, as will be seen from the following table:

Experiment.	Theory.
C 29.84	C ₃ H ₅ ZnO ₃ .
H 4.52	29.63
Zn 26.77	4.13
	26.75

The following equation explains the formation of this acid.



The insolubility of this salt in alcohol, its non-decomposition at 150° C. (sarcocollate gives off vapours at this temperature), and its crystalline form, sufficiently prove that it is the ordinary lactate of zinc, and not the sarcocollate.

The cyanhydrine of aldehyde is, then, isomeric, and not identical with the cyanhydrine of glycol of Wislicenus, seeing that it gives ordinary lactic acid with hydrochloric acid, and that it is converted into a resin by potash instead of giving sarcocollate acid. Moreover, the cyanides of the glycols have no disposition to evolve prussic acid and cannot be obtained in quantity and in a state of purity, whereas our body can be found in any quantity and perfectly pure.

We have endeavoured to obtain the vapour density of this body by Dumas' method, but without success. On heating the balloon containing our body till 210° in an

oil-bath and removing it from the bath, we observed that the aldehyde had been converted into a resin. On deducting its weight from the weight of the balloon the density of the vapour approached very near that of prussic acid. It appears to us, however, to be sufficiently proved that this compound only contains one molecule of each of the parent bodies, from the facts that it gives lactic acid with hydrochloric acid, and that it separates by the action of heat into prussic acid and ordinary aldehyde, and not into aldehyde or paraldehyde.

It appears to us that time is a very striking example of an organic body which is dissociated by heat and re-constructed by time.

NOTE ON THE

ACTION OF PEROXIDE OF MANGANESE UPON URIC ACID.

By C. GILBERT WHEELER.

THE oxidising action of a peroxide upon organic substances varying to some extent according to the peroxide employed, I have investigated the action of peroxide of manganese upon uric acid.

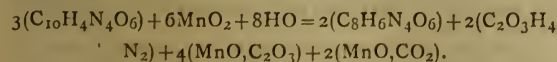
If uric acid and peroxide of manganese are heated together with a like quantity of water, and sulphuric acid is added in small portions at a time until no further action is to be observed, the black pasty mass then filtered, and the filtrate evaporated to about one-fourth of its original volume, there is obtained after considerable time, a quantity of large hexagonal crystals, which by analysis and characteristic re-actions was found to be parabanic acid.

If uric acid is heated with a large quantity of water only, until the latter is brought to the boiling-point, and then peroxide of manganese added as long as evolution of carbonic acid occurs, and the mass filtered, there remains on the filter peroxide of manganese and oxalate of manganese, while the filtrate on being somewhat concentrated yields crystals, which if again dissolved and treated with animal charcoal may be obtained colourless and quite pure. They were tasteless, rather difficultly soluble in cold but readily soluble in warm water; the solution gave with chloride of mercury no precipitate, while a very voluminous one was obtained on adding the nitrate of the same base; nitrate of silver and ammonia gave a white glistening precipitate; on heating, cyanide of ammonium was evolved.

0.3595 gramme yielded on combustion 0.133 water and 0.398 carbonic acid; which relation indicated the substance to be *allantoin*.

	Found.	Theory.
C	30.13	30.4
H	4.09	3.8

The mother-liquor contained much urea; also an amorphous substance, the quantity of which was too trifling to admit of an analysis. The action of the peroxide of manganese may be explained by the following equation.



If uric acid is heated with peroxide of manganese in the presence of but a small quantity of water there is formed urea, oxalic and carbonic acids, and but a very small quantity of allantoin; the action of peroxide of manganese upon uric acid resembles therefore very closely that of peroxide of lead.—*American Journal of Science*, Sept. 1867,

NOTE UPON A

METHOD OF VARYING WEIGHTS BY MINUTE QUANTITIES.

By J. A. BROWN, F.R.S.

A notice of a Gravimeter, proposed by me, appeared in the *Proceedings* of the Royal Society of Edinburgh early in 1861. The instrument, with various modifications, was forwarded to me in India about three years thereafter, and was found to have several imperfections which could have been corrected only by my own supervision of the work as it proceeded. His Highness the Rajah of Travancore has been good enough to sanction a sum of money for the construction of a second instrument, with all the precautions experience has suggested.

There are two methods by which the observations may be made. One, by which there is a constant angle of torsion of a single wire giving a variable angular movement to the weight suspended by two wires (depending on the force of gravity at the place of observation). The other, by which the weight suspended is varied, and the angles of torsion of the single wire and movement of the weight are constant. This second method I had at first rejected, as experience had shown me the difficulty of changing the weights without affecting the stability of the instrument. I desire now to note that I devised, about a year ago, and communicated to different men of science, a method of varying the weight, suspended with the greatest delicacy, and without jar to the instrument. This method consists in suspending from the weight a metallic wire, which enters a piece of barometer tube fixed below the instrument: by means of a screw entering a cistern below the tube, mercury (or another fluid) can be forced into the tube so as to immerse the metallic wire in the fluid; the wire being properly chosen as to fineness, or as to its specific gravity compared with that of the fluid, and the height of the fluid being read to a thousandth of an inch as in the barometer, the weight suspended can be made, by turning the cistern-screw, to vary gently and gradually, by as minute a quantity as we please; while the eye is occupied with the coincidences of the telescope wire and its images, which indicate the constancy of the angles of torsion of the single and double wires.

Although the difference of the specific gravities is considerable, I propose to employ iron for the wire and mercury for the fluid.

It has occurred to me that this method of varying a weight might be of use in other branches of research.—*Proceedings of the Royal Society of Edinburgh*, Session 1866-67.

NOTES ON POWDERED CASTILE SOAP.

By JOSEPH P. REMINGTON, Brooklyn, N.Y.

THE following notes are contributed to the present fund of knowledge on the subject of drug powdering:—

Exp. 1. 986 avoirdupois ounces of white Castile soap (Conti) were shaved into thin slices, by means of a common cabbage cutter, then spread on shallow trays, and exposed to the air in a drying room, temp. 84° F., for one week, transferred then to a drying room, temp. 125°, and left there three weeks, at the end of which time it weighed 724 ounces avoird., thus losing 26.57 per cent of water; it was then powdered in the ordinary chaser or Chilian mill, and lost 7 ounces more in the process of pulverising, making the total loss 27.28 per cent.

Exp. 2. 960 ounces avoirdupois of the floating variety of white Castile soap, after standing in a moderately dry room for fifteen months (losing 224 ounces, or 23.3 per cent,) on being further dried and powdered, in a similar manner, lost 56 ounces more, making a total loss of 280 ounces, or 29.16 per cent.

Exp. 3. 1,112 ounces avoirdupois of mottled Castile soap (commercial) treated precisely in the same way, lost 320 ounces, or 28·8 per cent. The average loss on five previous lots was 21 per cent, the amount of water present varying in each case, losing respectively 20, 11½, 18, 27 and 29 per cent. The lots which lost 11½ and 18 per cent had undoubtedly been kept some time, and in the case of the lot losing 11½ per cent, half of the water which would help to form the ordinary loss was lost before it was sent to powder. The first and last experiments were made with soap recently imported. It will be noticed that in these experiments (which I may state were carefully conducted) that the mottled Castile soap does not support its reputation for strength (its only credited merit over the white.) According to the U. S. Dispensatory, good mottled Castile soap should not contain more than 14 per cent of water; this contained, then, double the proper amount. The same authority states that white Castile soap should not have more than 21 per cent; in both experiments with the white; it was found to contain an excess of at least 6 per cent of water.

There is an important reason for not putting the soap in the room of higher temperature at first, for it would then melt, instead of drying properly, and become unmanageable. The powder from the first experiment was fine, light, and very white; that from the second was not so white, owing, probably, to the fact of its being kept a greater length of time and the presence of a little sesquioxide of iron, the colour of the iron being masked when the soap was fresh, as in the first experiment, the iron being then in the state of protoxide; 21 cents per lb. was paid for the white soap (in *Exp. 1*) which was a low figure (Feb., 1867), and as the loss was 27·28 per cent., allowing 12 cents per lb. for powdering, the lowest cost of the powder would be 38 cents, and yet a powdered white Castile can be *bought* for that price; the inference regarding the character of such a powder is of course unmistakable. It would be an easy task for the pharmacist to prepare his own powdered soap, the only necessary outlay would be for that unscientific instrument, the cabbage cutter, which, however, could be used with advantage in making tinct. sapon, camph., opodeldoc, soap plaster, &c., not to speak of its legitimate use; for small operations the soap could be shaved with a spatula. If a drying room is not at command, the difficulty of drying it thoroughly may be overcome by shaving the soap very thin, then spreading on paper and setting in a warm place; the drying of course is hastened by a current of air. After it becomes dry and friable, it can be easily powdered in a mortar and sifted through a fine sieve, and the pharmacist has then the satisfaction of saving the difference in the cost of powdering and of furthering the cause of "*Medicinæ Puritas.*"—*American Journal of Pharmacy.*

PARIS EXHIBITION OF 1867.

(FROM OUR SPECIAL CORRESPONDENT.)

MESSRS. HOPKIN AND WILLIAMS, of New Cavendish Street, London, have a most remarkable display of rare and valuable chemicals. It is not too much to say that these gentlemen have, by the articles they have exhibited, shown themselves to be second to none in their profession for chemical skill. The collection of specimens illustrating the chemical history of thallium and its compounds is absolutely unrivalled, and casts into the shade every thing that has been done by the French chemists. This series of compounds is far too remarkable to be cursorily passed over; we shall, therefore, describe them *seriatim*, as briefly as is compatible with doing justice to the subject.

Metallic Thallium.—This is shown in the form of a large bar, weighing 2 lbs. It has a dull leaden colour, owing

to a film of oxide. It is only necessary, however, to wash the bar in water to obtain it with a brilliant metallic lustre. The water becomes strongly alkaline, and is in fact a solution of oxide of thallium.

Oxide of Thallium.—This substance yields a colourless solution when dissolved in water, it is strongly alkaline, and precipitates solutions of nitrate of silver, &c., as if it were a solution of hydrate of potassium. On concentration of the aqueous solution of oxide of thallium, it deposits yellow crystals of the hydrate; these crystals lose water very readily, yielding the dark coloured mass of dry protoxide of thallium as exhibited. If dried *in vacuo* so as to prevent the formation of traces of peroxide the salt would be colourless.

Suboxide of Thallium.—When the metal is fused in the air a very mobile, dark coloured liquid is formed upon the surface of the melted metal; upon cooling it can be separated; it is insoluble in water, and has entirely different properties to the peroxide.

Peroxide of Thallium.—This specimen was prepared by adding a solution of hypochlorite of sodium to a boiling solution of protoxide of thallium, the peroxide is precipitated under the form of a brown powder.

Sulphate of Thallium.—A superb specimen of large and fine crystals about two pounds in weight.

Nitrate of Thallium.—A large specimen, colourless and well crystallised.

Chloride of Thallium.—About two pounds weight crystallised from twenty gallons of boiling water.

Perchloride of Thallium.—A very fine specimen produced by the action of nitric acid on a boiling solution of the chloride.

Bromide of Thallium.—This salt is less soluble than the chloride, and was consequently prepared by precipitation.

Iodide of Thallium.—Almost insoluble in cold or hot water; a cold solution of bromide is precipitated by iodide of potassium.

Periodide of Thallium.—Made by partially precipitating a boiling solution of the perchloride by iodide of potassium. The salt is dark brown, and if in the course of preparation an excess of iodide of potassium is used, it rapidly becomes converted into ordinary iodide.

Silicate of Thallium.—Prepared by decomposing a solution of nitrate of thallium with silicate of sodium; the solution is boiled, and on cooling deposits the silicate in crystals.

Phosphate of Thallium.—Produced in the same manner as the silicate, substituting phosphate for silicate of sodium. The phosphates of thallium require investigation.

The molybdate, vanadate, sulphantimoniate, sulphocyanide, cyanide, benzoate, oxalate, borate, chromate, bichromate, are also exhibited, but do not call for any special remarks.

Sulphide of Thallium.—This compound may be produced by fusing thallium and sulphur together. Sulphide of hydrogen does not precipitate the solutions of the sulphate, nitrate, &c., but an abundant precipitate is produced in the solution of the acetate, and as thus prepared it can be washed and dried, but if precipitated by sulphide of ammonium, and the precipitate be washed, &c., when approaching dryness it will take fire even at a very moderate temperature. In fact, Messrs. Hopkin and Williams informed your correspondent that they could not succeed in preparing a permanent sulphide of thallium by this process.

Carbonate of thallium, upwards of 1lb in weight, and in good and white crystals, is also an interesting salt.

There were also exhibited the acetate, chlorate, bitartrate, and tungstate of thallium. Among the double salts we observed thallium alum, platino-chloride, sodio-tartrate, and the tartrate of thallium and antimony (thallium tartar emetic).

It would be impossible to estimate too highly the skill, perseverance, and chemical knowledge shown by this

firm in the preparation of the extraordinary and unrivalled collection of preparations of thallium contained in their case.

In addition to the above there is an admirable collection of fine chemicals, not mere showy crystalline salts, but preparations requiring far more than the average amount of scientific information for their production. The bottle of cantharidin contains nearly 5 ounces of superb white crystals of this substance. The specimen is the finest of its kind in the Exhibition, and is decidedly better than that in the case of M. Menier, although the latter is very good. It would be improper to pass over without notice the bromides of potassium and ammonium, and the iodide of ammonium.

The specimen of pyrogallallic acid has evidently met with an accident, and been subsequently put into a dirty bottle; this is unfortunate, as this firm for many years were by far the largest makers of it.

The crude oxalate of cerium which, is still used as a remedy in cases of obstinate vomiting, does not call for any very special remark. The same applies to the permanganate and cyanide of potassium.

The glacial phosphoric acid is very fine and pure. Large quantities of this substance are shown in the German department, and sometimes in sticks. In the latter state it has a very pretty appearance, but the German acid found in commerce is generally far from pure, containing soda, and almost invariably more than traces of lime and ammonia. Your correspondent is informed by Messrs. Hopkin and Williams that the syrupy phosphoric acid yielded by the action of nitric acid on phosphorus will never yield a solid brittle phosphoric acid by direct heating; no matter how elevated the temperature to which it is subjected, the product always remaining is a soft adhesive mass, and, at an elevated temperature, either partially sublimes, or, at all events, yields a volatile product.

The scale preparations of iron—for example, the ammonio-citrate, the ammonio-tartrate, the potassio-tartrate, and the citrate of iron and quinine—look very well, especially when their long exposure to light and heat is considered. These articles, although invented in France, have become enormously used in England, and are made upon a very large scale by several manufacturing chemists. The price in England is three or four hundred per cent cheaper than in France or Germany. The scale preparations in Messrs. Hopkin and Williams' case have certainly kept better than any others we observed, excepting, perhaps, the ammonio-citrate of bismuth which has turned black.

Taking it all together, we consider that Messrs. Hopkin and Williams' case is in the very highest degree creditable to them. It is quite evident that they do not allow themselves to fall behind any of their contemporaries; and considering the efforts that our chemical manufacturers are obliged to make to compete with the skilled labour and low wages which are such immense helps to their German rivals, this is saying a great deal.

We are glad to find that they have been awarded a silver medal.

Mock Scotch Soda Crystals.—These are properly sulphate of soda. It is, however, difficult to tell them from Scotch soda (washing soda of the shops) by the eye alone. They are prepared in the following manner:—A quantity of the ordinary "salt cake" is dissolved in a pan to 40 or 45° Twaddell; the liquor, if it shows acid, is neutralised with milk of lime, and 12 lbs of soda ash to every 100 lbs of the sulphate of soda is added in solution. The liquid is allowed to settle and then drawn off into coolers to crystallize. The resulting crystals are large and hard; they are dried in the air for a short time, and then packed in casks. To make the crystals larger and more firm a greater quantity of soda ash is used. One ton of roasted cake will make about 40 cwt. of these crystals. They are very frequently sold for the best Scotch soda.—*J. H. Swindells.*

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, OCT. 29, 1867.

Animal Miasma—Spectrum of the Bessemer Flame—Meteoric falls in Greece—Silurian System of Bohemia.

DR. J. LEMAIRE continues his researches on the nature of miasma exhaled by the body of a healthy man. He finds that it is on the periphery of the body and outside the organs on which develop the microphytes and the microzoaires on a man in good health. The deposit, vulgarly termed "dirt" or "scurf," that the perspiration, mingled with atmospheric and other dust contained in the linen produce on the skin, and which accumulates every day, if the body be neglected, gives rise to myriads of microphytes and microzoaires. They are the more numerous according as the deposit is more abundant. This coating contains an albuminoid matter capable of coagulation, furnished by the perspiration, which also maintains it in a humid state.

The contact of the air and the mean temperature of the neighbouring body, about 37° C., are the cause that this crust is in the most favourable condition for fermentation to take place, and the infusoria to be disengaged and developed. In studying the effects on men and women from 30 to 70 years, whose cleanliness had been neglected for a week or two, there were remarked a fetid odour in various parts of the body, and a slightly acid liquid containing transparent spherical ovoidal and cylindrical bodies similar to those found in the confined air of the Eastern fort; thousands of bacteria (*Bacterium termo*, *Bacterium catenula* formed of 2, 3, 4 and 5 articulations, *Bacterium punctum*), vibrios, &c.

In the former experiments the presence of entirely developed animalculæ six hours after the condensation of the aqueous vapour of the barrack-ward, can be explained by the elevated temperature of the human body and the existence of a great quantity of vapour in this air. They are no doubt furnished by the elevated temperature of the climate and the animal heat in adults, which produce miasma so fatal in tropical climates to man and beast.

Professor A. Lielegg has continued his researches on the spectra of the flame in which the melting is carried on according to the Bessemer system. This flame being only carbonic acid gas in an incandescent state, and the spectrum of this gas being yet unknown, the observations of M. Lielegg have served to fill up a gap in the series of spectra produced by the gases in combustion. The apparition and the disappearance of some of the luminous fixed lines is closely connected with the metallurgical operations. At the moment when the decarburisation of the iron is nearly terminated, these spectral lines assume essential modifications. The apparition of a group of lines and of an isolated line in the violet-blue portion of the spectrum, marks a particular movement of the period during which the soft iron is being formed, and these lines disappear sooner than all the others; their appearance and disappearance serve, therefore, to indicate the termination of the process.

In a letter addressed to M. Haidinger, M. Jules Schmidt gives some notes upon some igneous meteors observed in Greece. The meteoric fall of Nauplia was observed the 17-19 June, 1850, about ten o'clock at night, by M. A. R. Logothetis. In a perfectly clear sky, the meteor, like a swarm of falling stars, seemed to travel from East to West, and fell at the North of Nauplia near Tyrinthia. Shortly after its appearance a loud explosion like thunder was heard. The search made on the following day gave no trace of meteoric substances. It was only subsequently that a fragment of black stone was brought to M. Logothetis. This fragment, lost by carelessness, was about twice the size of an egg, and had the aspect of a metallic substance subjected to the action

of fire, presenting here and there reddish golden specks. It evidently contained metallic iron and sulphur. A meteor of the first magnitude was observed at Athens on May, 1857, at 11h. 46m., at 20° N.W. of the zenith having its radiating-point situated between Scorpio and Sagittarius. It was bright green, with a beautiful red trail. A sudden explosion accompanied the trajectory, which only lasted a second. An explosion similar to that of a heavy cannon was heard about a mile and a half fifty-three minutes after its extinction. The conclusion is, that the detonation took place fourteen geographic miles from Athens, at the height of about thirteen miles above the plain of Thebes. A similar meteor but much smaller was observed the 16th May, 1862, at 8h. 24m. The catalogue of M. Schmidt states the occurrence, for the 17th May, of eleven great meteors, four of which were terminated by showers of stones; on the 26th May, date of the fall of the meteoric stone of Agram (1751), seven meteors, two of which were accompanied by showers of stones, and one by the fall of meteoric iron. An enormous one passed over Greece on the 27th May, 1867, at 2½ to 3h. in the morning.

M. J. Barrande published in July a new continuation of his magnificent work on the Silurian system of the centre of Bohemia, a volume in 4to, containing 179 pages and 16 plates, treating on Pteropode mollusca (69 species, included in 8 genera) the remains of which are included in this formation and others, such as Columates, Trochocystites, Chittons, and Rhombifera. F. MOIGNO.

PROCEEDINGS OF SOCIETIES.

ROYAL INSTITUTION OF GREAT BRITAIN.

On some Experiments of Faraday, Biot and Savart, by JOHN TYNDALL, Esq., L.D., F.R.S., Professor of Natural Philosophy, R.I.

THE discourse was delivered at the request of the excellent President of the Royal Institution. The speaker had no new discovery to make known, and the utmost he could hope to achieve was to give a few old discoveries in such a form as would interest an intellectual audience.

A few of the more striking phenomena of electro-magnetism were first exhibited by means of a helix and a core of soft iron. The question arose, "suppose that core to be transparent, what would be the effect of its magnetisation upon a beam of light passing through it?" Probably such a question presented itself to the mind of Faraday. But iron was not transparent, and our great experimentalist had to seek long before he found a transparent substance, which enabled him to demonstrate the action of magnetism upon light.

Light in its natural condition was not sensibly affected by magnetism. The speaker then defined and illustrated, by means of a Foucault's prism and a plate of tourmaline, the action of "plane polarized light." He then showed the chromatic phenomena produced when a plate of rock-crystal, cut at right angles to the axis, was placed between the polarizer and analyzer of a polariscope. He also defined and illustrated, by means of the tourmaline, what was meant by the plane of vibration and the plane of polarization.

A plate of quartz, composed of two semicircles, the one belonging to a right-handed and the other to a left-handed crystal, was placed in front of the electric lamp, and through the plate was sent a beam of plane polarized light. The beam then passed through two perforated masses of iron, which rested on the two ends of a powerful electro-magnet—these pieces of iron were in fact the movable poles of the magnet. Beyond the furthest pole was placed a Foucault's prism, through which the beam also passed,

being finally received upon a white screen. A lens was introduced between the circular plate of quartz and the magnet; and by this lens a magnified image of the plate of quartz was thrown upon the screen.

The speaker showed the changes of colour produced when the plane of polarization was caused to rotate. Bringing, for example, the entire image of the quartz plate to a delicate puce, the slightest rotation of the Foucault's prism coloured one of the semicircles a vivid red and the other a vivid green. Restoring the puce colour, and placing a bar of the heavy glass with which Faraday first demonstrated the action of magnetism upon light from pole to pole of the magnet, the beam was transmitted by the glass, and the image upon the screen was unchanged.

On now exciting the magnet, the uniformity of the colour disappeared; one semicircle ran rapidly into a vivid red, the other into a vivid green. The relative position of the colours changed when the direction of the current was changed: when the current was interrupted, the puce colour was restored. Thus it was proved that the act of magnetization produced the same effect as the mechanical rotation of the plane of polarization; and this is the celebrated experiment which Faraday described as the magnetization of a ray of light.

The beautiful experiment of Biot on the influence of sonorous vibrations on plane polarized light was next thrown into a form which allowed the whole audience to see the effect. A rectangle of glass, 6 feet long, 2 inches wide, and about ¼ of an inch thick, was clasped by a clamp at its centre, being so placed between the polarizer and analyzer that the beam crossed the glass rectangle near its centre. The polarizing prisms were placed so as to darken the field of view. A sweep of a wet cloth over the distant half of the glass rectangle brought out its tone, and immediately a luminous disc a yard in diameter flashed out upon the screen. Every sweep of the cloth threw the glass into sonorous vibration and illuminated the screen.

A plate of selenite was so placed between the polarizer and analyzer as to show a system of vividly coloured rings. By a suitable arrangement of the experiment, the colours were wholly obliterated when the glass rectangle was thrown into longitudinal vibration.

None of these effects could be produced when the polarized beam passed through the rectangle near one of its ends; for here, as is well known, the necessary strains and pressures were absent.

The remaining experiments had reference to the action of sonorous vibrations upon jets of water. A vein was discharged obliquely from the nipple of an ordinary gas burner. The vein broke into scattered drops. By the light of the electric lamp, a dense shadow of the vein was thrown upon a white screen; on sounding an organ pipe, or a tuning-fork of the proper pitch, the drops suddenly gathered themselves together, forming an apparently continuous band several feet in length. On the suspension of the sound the drops broke asunder as before. The minuteness of the vibration, which is competent to produce this effect upon the vein, is extraordinary. After a tuning-fork had ceased to be heard, when placed against the support of the nipple from which the vein issued, the drops gathered themselves together, and remained in coalescence long subsequent to the apparent subsidence of the motion.

A jet of water was permitted to descend vertically. Its two portions, the continuous and the discontinuous, were described. An arrangement was devised by which the vein was vividly illuminated from above. The continuous portion was of dazzling brilliancy; the point of rupture being thus rendered strikingly manifest. On sounding the proper note, the continuous vein shrunk almost up to its aperture. The effect of beats was very fine; as they addressed the ear, the lengthening and shortening of the luminous cylinder, in perfect synchronism with the beats, went on. Here also the amount of motion, if only of the proper quality, which influences the vein, may be infinitesimal; the vein, in fact, declares the existence of the beats long after the ear has ceased to hear them.

MANCHESTER LITERARY AND PHILOSOPHICAL
SOCIETY.

Ordinary Meeting, October 15th, 1867.

J. P. JOULE, LL.D., F.R.S., &c., Vice-President,
in the Chair.

"Note on the Occurrence of Sulphocyanide of Ammonium
in Gas Mains," by PETER HART, Esq.

A few months ago while some gas mains in the street were being replaced, I was induced to examine the scale which forms in the interior, being under the impression that probably I should find sulphide of iron the result of long-continued action of sulphide of hydrogen on the iron. On placing a portion of this scale in pure hydrochloric acid I perceived an intense reddening, much more than would be accounted for by the simple solution of peroxide of iron, and being aware of the fact of sulphocyanogen being one of the products of the distillation of coal, I at once suspected its presence. A portion of these scales was boiled in water. The clear filtrate from this gave off much ammonia on the addition of alkali, and on the addition of a dilute solution of perchloride of iron it gave at once the intense colouration so characteristic of the sulphocyanides. The insoluble portion remaining on the filter was then boiled in dilute caustic soda; the filtrate from this made acid, and a solution of ferric oxide again added, this time with the production of a blue precipitate indicative of a ferrocyanide. This must have existed as ferrocyanide of iron, which on boiling with the alkali became oxide of iron and ferrocyanide of sodium. There appears to me something curious in the fact of these bodies being carried such a distance (in this case fully a mile from the gas works) by the gaseous current. I should think the ferrocyanogen is the result of a reaction between the sulphocyanogen and the metallic or oxide of iron. The amount of these bodies must, I think, be far too small to have any bad effect on the health of gas consumers.

"Jupiter as observed at Ardwick on the night of August 21st, 1867," by J. B. DANCER, F.R.A.S.

The somewhat rare phenomenon of Jupiter without a visible satellite extraneous to his disc (as the Rev. W. R. Dawes has correctly designated it) has been described in the *Astronomical Register*. I am not aware, however, that any notice of it has appeared before this Society, and as few observers appear to have enjoyed such favourable atmospheric conditions as we did in this locality, I am induced to offer a few remarks on the appearance which Jupiter presented on the night of August the 21st.

During the early part of the evening the S. and S.E. portions of the heavens were covered with thick haze; between 8 and 9 o'clock this gradually disappeared, and the atmosphere became clear and unusually favourable for astronomical observations. Preparations had been made for noting the times of the phenomena, but from various circumstances this was abandoned. The observations were made with an achromatic telescope of 7½ feet focus and 6½ inches clear aperture. Powers employed, 90, 175, and 300. At 9 o'clock Jupiter was clearly defined and presented a remarkable appearance. On the broad south belt three spots were distinctly visible, and at the same time three satellites appeared off the disc. The first spot in the order of transit was very black—this was the shadow of the third satellite. The next spot was brown in colour when contrasted with the belt—this was the third satellite; and the third spot, which was the shadow of the fourth satellite, was very dark and well defined. At this time the fourth satellite appeared very faint in comparison with the first satellite, which was just below it. The second satellite, which was on the west edge of the planet, was soon eclipsed, and attention was entirely directed to the fourth satellite, which was the next to transit. As this satellite entered on the disc it was visibly brighter than the planet;

after a short time it disappeared, and then, to my surprise, it became visible again as a dark spot, and at intervals it was as black as its own shadow. The alteration in the colour of this satellite during its transit has been noticed by several observers, but I was not prepared for such a complete change from a bright object to one as black almost at times as an ink spot. During these observations the first satellite had entered on the disc of the planet, and when it was about half its diameter on the planet it appeared to me to be in contact with its own shadow. After a short time I could only distinguish the first satellite at intervals, closely following its own shadow. Before the third satellite passed off the disc it became nearly invisible, and when close to the edge of the disc it appeared brighter than the surface of the planet. The fourth satellite was not observed at the end of its transit.

Mr. Robert Worthington, F.R.A.S., observed some of the phenomena with me, and remarked at the time that he did not recollect having seen Jupiter so sharply defined as on that evening. The bays and various markings on the belts were most beautifully distinct.

"Notes on some Superficial Deposits at Great Orme's Head, and the Period of its Elevation," by R. D. DARBI-SHIRE, B.A., F.G.S.

MICROSCOPICAL AND NATURAL HISTORY SECTION.

October 7th, 1867.

J. B. DANCER, F.R.A.S., President of the Section,
in the Chair.

The President, in his address to the members of the Section, described the various additions and improvements which had taken place in microscopes and apparatus, and gave a summary of the microscopical researches which had been communicated to various societies, both English and Foreign, during the past year.

The following extract of a letter dated 27th of August, 1867, from Captain Mitchell of Madras, was read:—

One or two things have come under my notice, which a friend who arrived in Madras from London a short time since, said he believed were unknown to microscopists in England, I therefore send you a brief notice of them, in the hope they may interest some of the members of the Society.

The first is the presence of ciliated infusoria in dewdrops on leaves. I have to confess I took the subject up in jest, in consequence of a remark in an article published in one of our local papers; about sunrise I placed an animalcule cage under the point of a leaf and transferred the drop of dew gathered there to the glass plate, and then examined it with the microscope. I repeated the experiment on two other occasions, and the result was, that in about one drop out of every two I found one, and sometimes two infusoria.

As the dew did not begin to fall until midnight, they must have been produced from the germ between that time and 6 a.m.

On the first occasion I saw also what I took to be one or two spores of fungi. I supplied the cage with distilled water and put it by until the next morning, when I found a perfect forest which continued to multiply so long as I supplied it with distilled water, which I did for several days. It will be interesting to ascertain if infusoria are found under similar conditions in England.

Some time ago Mr. Ross sent me a binocular body for my stand (one of his father's make). I have in my cabinet the tongues (so called) of two house flies, which I had mounted some years back. I was always under the impression that the divided absorbent tubes were enclosed between the two membranes that form the upper and lower surface of the two lobes, and I believe that is the general opinion of their structure; now on placing one of these specimens under a half-inch glass with the binocular body.

I was not a little astonished to see the tubes standing out above the surface of the membrane on the lower or under part of the tongue.

I was always at a loss to understand the use of these very curious vessels, but it now seems evident that fluids may be taken up by them and conveyed to the larger central tube into which they all run. It is I presume known that these tubes all open on the upper surface of the lobes by the other and narrower extremity.

Mr. LATHAM read the following communication on Silk-producing worms from Natal :—

In the *Natal Herald* of the 8th August last, there are copies of a correspondence between the Chamber of Commerce of this place and some gentlemen at Natal regarding certain silk-producing worms, as they are termed, found near Graham's Town by Mr. Hillier, feeding on the leaves of the mimosa thorn or acacia.

The result of the correspondence was, that some of the cocoons were presented to the Chamber here to have them reported on and their true value ascertained.

They came into my hands, and the following remarks on them may be interesting to the Society :—

From one of the cocoons the moth now exhibited emerged shortly after its arrival in England, and though much crippled, I have, through the kindness of Mr. Jansen, had it clearly identified with the insect "Pachypasa effusa," of which there are several specimens in the British Museum collection from Natal.

The moth laid about 50 eggs, of which I have mounted two or three, and they are here for examination.

The eggs under the microscope exactly resemble in texture those of the ostrich, but each has a small black point, probably of a softer substance than the rest of the egg, and through which the caterpillar may emerge.

From one of the cocoons I extracted the chrysalis also exhibited, and further the cast skin of the caterpillar rolled into a small ball as usual ; by boiling this for some time in caustic potash, it became so softened that it was possible to get it to its original size, and to show its original form. You have it before you dried, and the series is therefore complete, egg, caterpillar, chrysalis, moth, and cocoon.

The original cocoon is, you will notice, a hard woody-like substance, but by certain processes, Mr. Hillier states soaking in a solution of soda, the cement agglutinating the silk is dissolved and a soft silky-looking bag remains.

This consists of a thick outer covering, a loose middle lining, and a thinner internal lining, all of silk, which I hardly think could be wound but might possibly be carded.

As regards the commercial value of the article, an eminent silk broker writes as follows :—

"It is a carded cocoon, the waste silk is the outer covering of the cocoon and appears of tolerable fine fibre, but is bad in colour and not of a good merchantable appearance, if in quantity worth perhaps 1s. 6d. per lb. all round.

"Enquiries of a similar nature have been made from time to time by customers in the East, where silk does not form one of the staples of the country, and among other places, from Natal, but we do not find that any good can arise from efforts made to produce silk in any quantity ; it is probably the most difficult of all known staples to establish in a new land."

ACADEMY OF SCIENCES.

OCTOBER 21, 1867.

(FROM OUR OWN CORRESPONDENT.)

The Newton-Pascal Forgeries—Volcanic Phenomena—Discovery of the Law of Gravitation—Theory of Solar Spots—Determining the Longitude—Formation of Crystals of Gypsum.

SIR DAVID BREWSTER addressed to M. Chevreul, in terms of great friendship, a new letter against the authenticity of the autographs of M. Chasles, which he calls the most audacious imposition of modern times. This attack of our

illustrious and venerable friend gives us great pain, and the more so as it is reduced to a series of assertions immediately confuted by incontestable facts.

1. "King James II. could not have written to Newton from Saint Germain on the 16th January 1688, as he only arrived at the end of 1688." In the *Comptes Rendus* of the Academy, p. 551, the date of 1685 is evidently an error, as the second letter, posterior to that of 12 January, 1689, could have been no other than that of the 16 January, 1689.

2. "How could James II. have written to Newton, whom he knew to be an anti-Jacobite, and one of the conspirers to upset the throne?" In the letters of M. Chasles we read, in fact, that Newton was very embarrassed to have to answer King James ; that the King reassured him, saying that in repelling him from the throne he only did his duty.

3. "Newton could not have accused Flamsteed of the disagreements which called forth the injurious words against Descartes and Pascal inserted in the letter to Huyghens, since at that period Newton and Flamsteed were friends." All the correspondence known of this period, manuscript or printed, shows that Flamsteed always complained of Newton's treatment towards him.

4. "Who can believe that Louis XIV. would have occupied himself with an incident so insignificant as two two or three disdainful words uttered against Descartes and Pascal?" Authentic autographs of Louis XIV. prove, as Sir David could have seen by the note of General Morin, that the great king occupied himself with the change of garrison of a detachment of 25 to 30 men. Louis XIV. was also much occupied with the injury done, by Newton, to our two illustrious countrymen. There are mixed up in this affair not only James II. and the Abbé Bignon, but Huyghens and the celebrated astronomer Bouillaud, whom he made his confidential adviser in matters relating to science and savants, by whose medium he negotiated the recall into France of Huyghens and Cassini. M. Chasles has in his hands the letters by which Louis XIV. asks Bouillaud to make a report on Newton's affair, invites Huyghens to return to Paris to give explanations on this subject, and excuses himself towards James II. for the susceptibility he had manifested on this occasion in indicating the duties of a sovereign towards his most illustrious subjects. Thus, we see, the assertions of Sir David Brewster are promptly refuted ; the timid and embarrassed style of Newton's letter to the King of France is revolting to him. M. Chasles besides the rough copy of the letter of Newton, possesses the answer to Newton on which we see the words "*Vu bon*" in the well known handwriting of Louis XIV. Evidently the ground is no longer tenable by the adversaries of the authenticity of the autographs of M. Chasles. Every objection raised against it becomes an argument in its favour. M. Chasles has indicated, without been obliged to do so, the source of these documents,—the cabinet of Desmaizeaux ; it is now known that they were purchased by the Chevalier Blondeau de Charnage ; that two English gentlemen, Messrs. T. Winthrop and W. Robertson, wished to purchase them for 40,000 francs. It is even impossible that there does not remain among the papers of Newton's family in the possession of the Earl of Portsmouth and the Earl of Macclesford, traces of this negotiation and of the relations between Pascal and Newton. We know also the greatest number of the portfolios from the cabinet of Desmaizeaux are in London, probably at the British Museum, since Desmaizeaux died in London ; it is necessary to find them, and thus furnish evident proofs of the absolute authenticity of the treasure of M. Chasles.

M. Fouqué, charged with studying in a chemical point of view the phenomena of the volcanic eruption of the Azores, which took place at the beginning of last June, writes that he has succeeded, not without great trouble, in collecting enough gas, rising from the bottom of the sea, to make the analysis, and to ascertain that it is entirely free from carbonic acid, and rich in oxygen.

M. Babinet fixes the year 1670 as the epoch of the definitive discovery, by Newton, of the laws of universal gravitation. It was only then that he finished the calculation of the fall of the moon upon the earth. At the moment when he foresaw the result of his calculations conformable to his previsions, he was obliged through illness to get them finished by a friend.

M. Kirchhoff and M. Faye agree upon the theory of solar spots, which the latter attributed to an opening in the solar photosphere, allowing the kernel to be seen, the emitting power of which is inferior. M. Faye continues to deny the possibility of the transmission of light through the nucleus.

M. Faye announced that the new method of determining the longitude by M. Littrow, has given the best results.

M. Dronke, professor of Chemistry at Coblenz, read a note on the gradual formation in a mass of clay of crystals of gypsum, some of which were 14 centimetres long.

F. MOIGNO.

QUEKETT MICROSCOPICAL CLUB.

THE monthly meeting of this Club was held at University College on Friday evening last, Oct. 25. (Mr. Arthur E. Durham, President, in the chair).

Mr. S. J. McINTIRE read a paper on "*Chelifers*," in which he gave some interesting facts with regard to the haunts, habits, and mode of capture of these curious animals, resembling minute scorpions and having the backward and sideway motions of crabs. Of the 54 known species 8 are British, and are chiefly found under the bark of trees, and in houses amongst old papers, &c., often rendering good service by feeding on the insects which are usually so destructive in old libraries. Several living specimens were exhibited under the microscopes, where their activity in the pursuit of their prey was conspicuous.

A paper by Mr. C. NICOLSON, M.A., "*On Object Glasses for the Microscope*," was read.

Nine members were elected.

THE WATER SUPPLY OF CALCUTTA.*

THE question of the water supply is now being agitated in Calcutta, and the first of these papers has been drawn up by Mr. Spencer, by order of the municipal justices.

The matter treated of in the report is taken under the following heads—subsidence, mechanical filtration, purification, nature of the purifying material. The Hoogly water it appears contains a large quantity of suspended matter, the greater part of which is very fine mud. The author thinks it would not be safe to estimate the amount of sedimentary matter at less than a cubic inch to a cubic foot of water. He therefore strongly insists upon the necessity of large reservoirs for the subsidence to take place in, so as to give the filter beds as little mechanical work as possible. There are some differences from the ordinary methods, and apparently advantages in the one recommended for the construction of the filter beds.

The water enters the beds considerably like a spring. It is supplied from a basin in the centre, and spreads gradually over the surface. The author says: "The water descends through the sand, not in straight, but in a series of conoidal lines, intersecting each other, and which converge below at the regulating apparatus, where

the water is bent upwards, as in a spring, before it reaches the lateral drains at the bottom of the bed." The purifying material is magnetic oxide of iron impregnated with carbon; it is mixed with sand, and fragments of some coarser material are added to act as retarding media.

It is necessary that the magnetic oxide should be porous, and for this reason the native mineral is not suitable. The author explains that a compact crystalline ore cannot be as effective as the same material when porous; few would be inclined to dispute the fact. In the preparation of the artificial magnetic oxide to be used, either spathic iron ore, or hæmatite is heated until the carbonic acid or oxygen is expelled. The heat required in the latter case must make it a rather expensive operation. The porous material remaining is impregnated with carbon.

The use of this purifying material, to which the name carbide has been given, is to destroy the organic matter in the water. The ordinary process of atmospheric oxidation proceeds more rapidly, we are told, by a magnetic attraction for oxygen, which the carbide possesses.

"The purifying operation which takes place in contact with the carbide, may be explained by stating, that the atmospheric oxygen in the water, is attracted into the pores or cells of this substance, in virtue of its magnetic nature—and because oxygen itself is also a magnetic body. The consequence is, that this purifying gas, like all other magnetic bodies, becomes polarised in the presence of a similar body, by which a complete change of property ensues. In a word, from a state of comparative inertness, which does not allow it to combine very readily with organic matter, this gaseous body suddenly becomes a most active agent of natural purification, viz., ozone."

The author's theory is ingenious, but like many beautiful things it is, we are afraid, fragile.

It is mentioned in the report that large purifying works have been constructed at Wakefield in Yorkshire, upon the plan recommended, and have proved very successful. Still it is a curious fact that so little has been heard of this process during the seven years in which the author says he has had practical experience with it. In remarking this we have no wish to disparage Mr. Spencer's process: on the contrary, if the purifying material possess the virtues accorded to it by the discoverer, it is especially our duty to protest against anything less than the universal application of the process in this country. The destruction of the organic matter contained in water used for drinking purposes is a question of immense importance. Unfortunately results obtained with any method by its discoverer, are apt to be viewed sceptically. There are many who believe such bodies as carbon, and magnetic oxide of iron, to act by the oxygen which has been condensed in their pores when dry, and that after being in contact with water for a time, the action becomes feeble, and finally disappears. We are not aware that any experiments proving the contrary in the case of the magnetic oxide of iron have ever been published if made. The subject is too important to allow of the passing over of facts, as if proved, without such has been shown to be the case by the most rigid tests. A few lines further on a quotation is inserted, containing an assumption which it is hardly possible to grant.

An examination of the Hoogly water suggested to the author the presence of decomposing animal matter in the water. Describing the odour emitted, he says:—"It was that peculiar odour which unmistakeably betokens those gases which are generated by decomposing animal matters." Shortly afterwards this statement occurs, in reference to the water passed through a carbide filter. "Subsequent analysis showed that it contained (0.60) a very little over half a grain of organic matter to the gallon—a quantity which is practically harmless, if composed of vegetable matter." Has the author any reason

* "Report on the Purification of the Hoogly Water for the Supply of Calcutta," by Thomas Spencer, F.C.S.

"Experimental Investigations connected with the Supply of Water from the Hoogly to Calcutta," by David Waldie F.C.S.

to suppose that the decomposing animal matter would be oxidised before the vegetable matter? Most chemists would oppose such a supposition, but the author makes use of it as a *quasi* fact.

The amount of organic matter in the water of the River Hoogly, after separation of sedimentary matter, is given, as well as that of the other constituents, in an addendum: organic matter and loss together equal 1.96 grains to a gallon. This amount includes certain small amounts of phosphoric and nitric acids, which were detected, but were too small to bear quantitative estimation. In the present scheme there would be 8 filter beds, and 5,000 tons of carbide is the amount estimated as necessary for the proper purification of the water which would pass through.

Mr. Waldie has been engaged for some time in making a minute examination of the constituents of both the water and mud of the Hoogly, believing the research would possess some scientific interest. The investigation, he says, is far from completion, but as the subject is now attracting considerable attention in Calcutta, he publishes some of the results obtained—those bearing on the suitability of the river as a source of water supply for domestic purposes. This water has been found to be superior to most of the other waters supplied to the town. These other waters are the tank waters, which the author found to be harder, and to contain much more organic matter—two, three, or four times as much. The Hoogly water is rather hard during the dry season, but by boiling the hardness is reduced to a very small amount. As regards organic matter, the river water is better than any of the London waters. In January and November it in no case exceeded 1.05 grains per gallon. During flood tide the organic matter is about twice as much as during ebb tides. Yet the highest amount obtained was rather less than two grains per gallon. The quality of the organic matter does not seem very satisfactory. The author says that when partially separated from saline matter, the organic matter in the Hoogly water, during the rainy season, resembled in its general properties, animal excrementitious matter; while in the dry season it more resembled urinous secretions. Certainly, water contaminated in this way must be very efficiently purified to make drinking it a harmless experiment. The soil of Calcutta is more or less penetrated by sewage water, all over the town; for the author found that the water from temporary wells, dug for the purpose, was “simply sewage water deprived of the greater part of its bad smell by passing through the earth.”

Mr. Waldie considers the permanganate of potash a doubtful means of estimating the organic matter in water; the oxidation test appears to indicate only certain kinds of impurities. According to this test General's tank-water (considered the best for drinking in Calcutta) contained as much organic impurity as the water of the salt marsh to the east of the town. The water of the circular canal, too, which receives the greater portion of the sewage of Calcutta, required no more oxygen than that of the best tanks. He believes the determination by weight to be the most trustworthy method. In summing up, the author says—As regards the inorganic constituents, the water of the Hoogly is at least as good as any supplied to London. The organic impurity seems to be worst during the rainy season; the water is purest in this respect in the cold season, and it is doubtful whether during the very hot season the organic matter equals that during the rainy season.

The Atmosphere of the Underground Railway.—On Wednesday Dr. Lankester, held the adjourned inquest relative to the death of a young woman who died at King's Cross Station. Scientific evidence was given as to the quality of the atmosphere in the tunnels by Professor J. E. D. Rodgers and Dr. Letheby. A special report has been prepared for this journal and will appear in our next.

CORRESPONDENCE.

THE CAMPHOR STORM GLASS.

To the Editor of the Chemical News.

SIR,—I see by your Notices to Correspondents that you sometimes have to answer inquiries respecting the storm glass and its value as a meteorological instrument. The frequent reference made to it by the late Admiral FitzRoy gave an almost official sanction to its use, and induced some instrument makers to manufacture it largely, and even to attach it to the ordinary barometer and thermometer. This led me to examine the storm glass with some care. I made one on a large scale, in a quart bottle, placed it on the window ledge, and kept a journal of its behaviour during some months. The conclusion I arrived at was that the storm glass is not acted on by light, or atmospheric electricity, or wind or rain, &c., but solely by variations in temperature; that it is, in fact, a rude kind of thermoscope, vastly inferior to an ordinary thermometer, and has no meteorological value whatever.

My paper on the subject is printed in the *Philosophical Magazine* for August, 1863. It produced a few remonstrances to the effect that I had degraded a pleasing instrument to the level of a toy. I believe it to be, as you replied to your correspondent, only a toy, but it is a very pretty one, and exhibits effects of crystallisation of great beauty and variety. I generally have one hanging up in a back window, and it affords me pleasure to look at it and to show it to my friends.

One of my conclusions, viz., that light has no action on the storm glass, was questioned by a gentleman with apparently so much reason and good sense that I gladly examined the case as put by him.

This gentleman had a storm glass hanging up in a west window of a house in a street in London. He was in the habit of observing it every day during a few years. He went to reside in the country, and hung up his favourite storm glass again in a west window. He soon noticed that the crystals were larger and finer than any he had ever seen in the tube when it was in town. He naturally referred the change to the increased light and brilliancy of the sky, as compared with the dingy atmosphere of London. On inquiry I found the change to be really due to heat and not to light. In the town house the sun disappeared some time before sunset behind the opposite houses. In the country house, the west window was in full view of sunset. Now, as soon as the sun came round to the window in the afternoon of every warm, cloudless day, it melted the solid contents of the storm glass, and allowed impurities to subside; but after sunset crystallisation again took place, excluding other impurities, so that these repeated fusions and recrystallisations produced the fine crystals, and not the improved light. Such at least is my explanation of this fact as stated.

I also proved some years ago that the motion of camphor and other volatile bodies towards the light, is really towards the coldest part of the bottle. The coldest part is generally towards the light, because on that side of the bottle radiation is most free. A gentleman wrote to me that my theory could not be true, because in a number of his bottles the deposits were on the sides farthest from the light. On inquiry it turned out that his shelves were erected against an outer wall, facing the north, so that the sides of the bottles nearest the wall were constantly the coldest.

By dipping a piece of filtering paper into ether, and placing it on a bottle containing a little camphor, &c., a deposit may be determined in a few seconds to any part of the bottle at pleasure, and of any pattern or device we may choose to give to the filtering paper, —I am, &c.

C. TOMLINSON.

King's College, W.C., Oct. 26, 1867.

VOLATILITY OF SESQUICHLORIDE OF IRON.

To the Editor of the Chemical News.

SIR,—Since writing the letter which you kindly inserted in your last issue, the subject of it has received fuller investigation at my hands, and the views therein contained are strengthened by the following experiments I have made:—

(1). Another sample of the best sulphocyanide of potassium, obtained from large operative chemists, tested with pure hydrochloric acid, gave a distinct pink tint. This sulphocyanide of potassium was dissolved in hot absolute alcohol, the solution filtered, cooled, and the crystals separated; they were then freed from alcohol by heat. An aqueous solution was made from the salt thus obtained and filtered.

(2). The aqueous solution tested with the pure hydrochloric acid used above, gave no tint.

(3). Mr. Skey's experiment was tried with this pure reagent solution. The sesquichloride of iron and hydrochloric acid were placed in a large watch-glass having ground edges, covered with a glass plate wetted on the under side with the sulphocyanide solution. After the lapse of several minutes, the cover was removed, placed upon white enamelled glass, and more of the test solution added. The experiment was repeated several times under varying conditions; with regard to the proportions of sesquichloride of iron and hydrochloric acid, in no case was any colouration produced in the sulphocyanide of potassium. Mr. Skey, who is evidently a diligent worker in science, has apparently misinterpreted the effect produced in a colourless solution of ordinary sulphocyanide of potassium by the vapour of hydrochloric acid.

In conclusion, Sir, I deny that at present we have any proof of the volatility of sesquichloride of iron at common temperatures.—I am, &c.,

HENRY SEWARD.

SCIENCE TEACHERS.

To the Editor of the Chemical News.

SIR,—Seeing that the subject of science teachers is under discussion in your columns, I venture to offer a few remarks, in the hope that something will be done to remedy the existing anomalous state of things with regard to science examinations; feeling, doubtless with many others, that a measure which bids fair to benefit the country, by enlarging the area of our educational basis, is failing from lack of well-directed energy to accomplish its desirable purposes.

It is admitted on all sides that the days when Latin and Greek should monopolise our school hours are at an end, and that it is necessary, in order to effect material progress, that our scholastic system should be modernised by bringing within its range those departments of intellectual culture in which, more especially, such rapid advances have been made in latter years. But I cannot think that the latest step on the part of the authorities at South Kensington is calculated to further the propagation of scientific knowledge, or to facilitate the introduction of chemistry and its concomitant sciences as recognised and essential branches of a middle-class education. I refer to the abolition of the November examinations for teachers, and the amalgamation of pupils and teachers at the May examinations. It is now only necessary for a candidate to obtain a first or second class certificate in order to style himself and act as a "science teacher." Such a sudden transformation of pupils into teachers cannot, I think, be productive of beneficial results; for it is certainly not a matter of difficulty for a pupil of 16 or 17 years of age, who has applied himself to his subject, to pass in the second, or even in the first class; but it is very rarely that such a pupil becomes

by this circumstance qualified to hold the responsible position of a teacher. It may be argued that there was so little difference between a third-rate teacher and a first-rate student that it was absurd to have separate examinations for them; but was not this fact sufficient in itself to prove the necessity of raising the standard of examination for teachers, instead of lowering it to that of the pupils?

This, then, appears to be the root of the evil. The examinations for teachers were never sufficiently stringent, or rather they did not sufficiently touch upon the real work of the teacher, which, in experimental science, is to a great extent of a practical nature. If a separate examination for teachers be again instituted, I would suggest, in order to render it more efficient, that something like the following scheme should be adopted:—

That no candidate should be allowed to style himself a "science certificated teacher" until he has passed in at least four subjects.

That there should be no second or third class; a certain standard to be fixed which all candidates must reach.

That there shall be a theoretical and practical examination in those subjects which admit of such treatment.

That each candidate shall be obliged to deliver a lecture of not less than half an hour's duration before a committee or board of examiners, on some portion of the subject in which he is a candidate, and that a few simple pieces of apparatus should be provided for the illustration of the lecture.

This last requisite I consider to be of the utmost importance, as lecturing forms the chief portion of a teacher's work, and his facility of expression, as well as his skill in manipulation, might thus be thoroughly tested.

I am of opinion that such a scheme as the above would meet with the approval of the majority of those concerned, and none more than science teachers themselves would appreciate the consequent elevation of their profession in the eyes of the public.

Doubtless objections will be raised on account of the extra time and expense involved; but has not experience shown that neither time nor money can be more wisely expended than upon education, and never with such certainty of ultimately yielding great and profitable results?—I am, &c.,

F. N. J.

October 29.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2828. A. Ticozzi, Bedford Street, Bedford Square, Middlesex, "An improved preparation or lotion for diseases of the eyes."

2832. J. Player, Glaisdale, Yarm, Yorkshire, "Improvements in the manufacture and refining of iron and steel."—Petition recorded, October 8, 1867.

2843. T. Blackhurst, Conway Street, Birkenhead, Cheshire, "A new or improved composition to be used to prevent the oxidation of iron, the fouling of ships' bottoms, and other submerged things, and preserving wood from decay and from worms, and also preserving iron and wood exposed to the action of the atmosphere."—October 10, 1867.

2848. A. M. Clark, Chancery Lane, "Improvements in the preparation or treatment of extracts of madder for dyeing and printing purposes, and in apparatus used in such treatment."—A communication from G. A. Schaaff and G. E. Lauth, Boulevard St. Martin, Paris.—October 11, 1867.

2874. E. Leitenberger, Cosmanos, Austria, "Improvements in treating madder for the purpose of obtaining purpurine or alizarine from the same, and in apparatus to be made use of thereby."—October 12, 1867.

INVENTION PROTECTED BY THE DEPOSIT OF COMPLETE SPECIFICATION.

3972. W. Brookes, Chancery Lane, "An improved method of treating hides in the process of tanning, and for apparatus employed therein. A communication from M. Michalich, J. Hallenstein, and A. Cleghorn, Footscray, Victoria."—Petition recorded October 22, 1867.

NOTICES TO PROCEED.

2606. G. Pickin, Birmingham, "Improvements in the treatment and preparation of mineral oils and spirits for illuminating and other purposes."—Partly a communication from H. Chadburn, St. Louis, Missouri, U.S.A.—September 16, 1867.

2745. T. Prideaux, Sheffield, "Improvements in blast furnaces or cupolas."—September 28, 1867.

1713. H. Fletcher, Old Hall Street, Liverpool, "Improvements in the manufacture of artificial fuel."—Petition recorded June 11, 1867.

1748. G. Mc Kenzie, Glasgow, N.B., "Improvements in the manufacture of illuminating gas."

1754. C. Erba, Milan, "Improvements on depilation and leather tanning."—June 15, 1867.

1767. F. B. Miller, Sydney, New South Wales, "An improved method of toughening brittle gold bullion, of refining alloyed gold, and of separating therefrom any silver they may contain."—June 17, 1867.

1803. H. K. York, Cardiff, "Improvements in the manufacture of steel."—June 20, 1867.

1819. G. Dickie, Kilwinning, Ayr, N.B., "Improvements in the manufacture of illuminating gas."—June 21, 1867.

1846. T. Crow, West Ham, Essex, "Improvements in the manufacture of illuminating gas from gas tar, oil, or from gas tar."—June 25, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Journal für Praktische Chemie.

No. 12, 1867.

A. MULLER, "Colorimetric Studies on Sulphate of Iron." A. MULLER, "On some Chromatic Relations between Solutions of Annatto, Acetate of Iron, and Dichromate of Potash.

Bulletin de la Société d'Encouragement. May, 1867.

CAULTIER DE CLAUDRY "Report on Guenier-Lauriac's Method of Casting Rolls and other objects with a Skin of Hard Iron."

Mittheilungen des Gewerbe-Vereins für Hannover. Nos. 1. and 2. 1867.

F. KERN, "On a new Vegetable Fibrous Material known as *Kollen-fister*, for stuffing Furniture." W. LIECKE, "Some Methods of Preserving Cast Iron." W. LIECKE, "On Coating Cast Iron with other Metals in the Wet Way." H. GROTHE, "On the Amount of Heat radiated from Steam Pipes, and on the use of a Jacket for preventing such Radiation." BEGEMANN, "On the Pollution of Wells by Cesspools and Privies." W. LIECKE, "Notes on Glycerine."

Le Technologiste. July 1867.

OUDEMANS, "On the Specific Gravity of Acetic Acid and of its Aqueous Solutions." F. JUNGEMANN, "Improvements in the Manufacture of Beetroot Sugar." H. ROBERTSON, "On a new Distilling Apparatus for the Extraction of Mineral Oils."

Dingler's Polytechnisches Journal.

July, 1867. No. 1.

BLAZEK, "On a Means of establishing Telegraphic Communication between Two Places without the use of a connecting Wire." J. L. FROMONT, "On Ammonia Vapour Pumps." C. BISCHOF, "Analysis of and Pyrometric Experiments on Grünstadt Fire-clay." G. SCHNITZER, "On Citric Acid." M. ROSLER, "On the Manufacture of Indigo Carmine." H. DEVILLE, "On the Use of Glycerine for preventing the Adhesion of Mercury to the Glass Tubes of Steam Gauges."

July. No. 2.

H. SCHEFFLER, "On the Use of the Thermometer for preventing Boiler Explosions." L. RINMAN, "On the Presence of Nitrogen in Steel and Pig Iron, and on the Condition of Carbon in Hard and Soft Steel." H. WAGNER, "On the Manufacture of Baryta and its Salts." M. ROSLER, "On the Manufacture of Nitrate of Iron for Use as a Mordant." CHEVALLIER, "A Method of rendering Mortar capable of resisting the Action of Rain by the Addition of Coal Dust thereto." CHEVALLIER, "On the Use of a Solution of Amber in Bisulphide of Carbon as a Cement." E. SOSTMANN, "On the Solution of Gypsum by Saccharine Solutions." H. RUST, "On the Discrimination of true Creosote and the so-called Coal Tar Creosote (Carbolic Acid)."

Comptes Rendus.

August 19, 1867.

M. CHASLES, "On the Pascal Correspondence." CHEVREUL, "On the Pascal Correspondence." SCHULTZ-SCHULTZENSTEIN, "Researches on Animal Electricity." C. OZANAM, "On the Representation of the Beats of the Heart and the Pulse by means of Photography." CONTE, "Supplement to the Author's Memoir on the Diseases of the Vine, published in the *Comptes Rendus* of August 12." C. GRAD, "On the Temperature of the Rivers Rhine, Ill, and Fecht." H. SCHIFF, "On the Monamines derived from the Aldehydes." L. CAILLETET, "On the Influence of Coloured Light on the Decomposition of Carbonic Acid by Plants." COULVIER-GRAVIER AND CHAPÉLAS-

COULVIER-GRAVIER, "On the Shooting Stars of the 9th, 10th, and 11th of August, 1867." JULLIEN, "Letter to Chevreul on Capillary Affinity." CHEVREUL, "Reply to Jullien's Letter on Capillary Affinity."

NOTES AND QUERIES.

Perfect Vacuum.—I have a recollection that some chemist described a method of getting a perfect vacuum some years ago. Can any of your readers refer me to the exact description?—ELECTRON.

Granular Effervescent Citrate of Magnesia.—It is stated on good authority that there is no citrate of magnesia whatever in the above popular medicine. Is this the case? If so it ought to be widely known. Can any of your readers give me a simple and trustworthy test for its presence in an effervescent mixture?—A SURGEON.

Manufacture of Epsom Salts.—Some weeks ago I noticed a correspondent asking, through Notes and Queries, at what towns in the north, Epsom salt is made on the plan I described in your journal some time ago. I should have answered this before but have been prevented through illness. I now beg to state, if is not too late, that Manchester, Bolton, Wigan, St. Helens, &c., are some of the places working on the plan described.—J. H. SWINDELLS.

Spontaneous Ignition of Charcoal.—Has this phenomenon ever been observed? A case has just come under my notice in which a considerable quantity of finely powdered wood charcoal has been found in a smouldering state. I have carefully examined into the circumstances, and can assign no reason whatever for the ignition except that it occurred spontaneously.—W. HOLMES.

Action of Salts on Glass.—It does not seem to be generally known that several ammoniacal salts act on glass at a high temperature. Thus fusing sulphate of ammonia and also a mixture of nitrate and chloride of ammonium, in a state of fusion attack glass. An ignorance of these facts has just led me astray in considering fluorine to be present where it was not.—MEDICUS.

MEETINGS FOR THE WEEK.

Friday, November 1.

GEOLOGIST'S ASSOCIATION.—On the Chief Groups of the Cephalopoda." by Rev. Thomas Wiltshire, M.A., F.G.S., &c.

Monday, November 4.

ROYAL INSTITUTION.—General Monthly meeting. 2 p.m.

Wednesday, November 6.

GEOLOGICAL SOCIETY.—First meeting of Session. "On the Loess and Gravel Deposits of the Valley of the Somme," by A. Tylor, F.L.S., F.G.S.

Thursday, November 7.

CHEMICAL SOCIETY.—First meeting of Session. "On Nitrous and Nitric Ethers," by Messrs. E. T. Chapman and M. H. Smith. 8 p.m.

TO CORRESPONDENTS.

A.P.—Write to Messrs. Wells and Hall.

A Constant Reader.—You must be very careful how you try the experiment. The apparatus will almost certainly explode.

F.O.X.—You must use slaked lime. Quick lime will not absorb carbonic acid. This is a sufficient reason for your failure.

Bellum.—Bell metal is an alloy of copper and tin, the proportions vary, but they are very near 76 of copper, and 24 of tin.

J. Barnes.—To answer your question it would be necessary to write a complete treatise on the science. We must refer you to the article "Crystallography" in Watts's Dictionary.

W.—Send stamps, and our publisher will forward the book. You ought to be able to get what you want through your local bookseller.

Olympic Company.—The more complex the composition of a glass, the more stable it is supposed to be. A simple silicate is readily devitrified.

Communications have been received from J. H. Swindells; Professor A. H. Church, M.A.; H. Wallis; D. Cameron; Walter Hall (with enclosure); H. Seward; W. Hill (with enclosure); J. H. Dickenson; W. Hoare (with enclosure); J. R. Smith; M. E. Taylor; J. Bird (with enclosure); J. Pain; S. Barnes; M. Willis; R. Newman; W. Delcomyn; G. King; Nicholas Pugh; C. R. A. Wright, B.Sc. (with enclosure); Dr. Odling, F.R.S.; Rev. Edwin Smith, M.A.; W. M. Bywater; E. Bennett; Jesse Fisher.

Books Received.—"Practice with Science, a Series of Agricultural Papers." Vol. i. London, 1867. Longmans and Co. "On the Qualifications and Duties of an Officer of Health," by Dr. Letheby. London, 1867. "Introductory Lecture to the opening of the Eighty-third Medical Session at the London Hospital," by Dr. Letheby. London, 1867. "The Journal of Materia Medica," by Dr. J. A. Bales and H. A. Tilden. New Lebanon, New York. "Scientific American." "American Artisan." "Journal of Gas Lighting." "The present State of Manufacture of Iron in Great Britain," by J. Lowthian Bell. "Catalogue of American and Foreign Scientific Books for Sale," by D. Van Nostrand. New York. "Mining and Petroleum Standard" and "American Gas-light Journal." New York. "Hardwicke's Science Gossip," November.

THE CHEMICAL NEWS.

VOL. XVI., No. 413.

THE ATMOSPHERE OF THE METROPOLITAN RAILWAY.

IN another part of this paper we give a full report of the inquiry relating to the air of the Metropolitan Railway. In the interests of the public the results of the scientific evidence here brought forward should not pass without comment. Considering the mode in which gas analyses generally, especially those of air, are performed, the work done by the chemical referees deserves high praise; but the inferences which the public are likely to draw from the condensed reports hitherto published are certainly not justified by a careful analysis of the whole of the evidence. For the sake of clearness we will here give a summary of the details. In the tunnels Professor Rodgers found—

1 of sulphurous acid in	40,789 vols,
" " " " " " " " " "	23,913 "
13 of carbonic acid in	10,000 "
18.7 " " " " " " " "	10,000 "

The average amount of oxygen found was 20.17 per cent, in one instance sinking as low as 18.7 per cent.

At Box tunnel there were found to be 20.3 per cent of oxygen; at Blackheath tunnel, 20.0; at the Crystal Palace tunnel, 19.7; at Birkenhead tunnel, 20.1 per cent; at Wolverhampton tunnel, 20.3 per cent. These figures are contrasted with Pimlico air, which contains 20.9 per cent.

Such results are very remarkable, and we confess we were not prepared for such a deficiency of oxygen in tunnels. The actual loss of oxygen is known not to be of great importance in itself, but as an indication of impurity it is one of the most delicate tests. When the oxygen is removed in small quantities by simple absorbents, it is not missed, but when it is replaced by the ordinary products of combustion and of respiration, the minutest portions make the deterioration of air evident to the senses. The deficiency here, according to Professor Rodgers, is as much as 20.9—20.17, or 0.73 per cent.

The amount of oxygen found in the bowels of the deepest mines of Great Britain was found in an average of several hundred cases to be 20.26, or more than in the Underground Railway, whilst the air of a large city has been found to contain 20.947. Now we can scarcely look on the air of London as worse than that, and we may safely say that if the air of Pimlico had been taken more frequently, a higher average than 20.9 would have been attained, although we agree with Professor Rodgers that 20.9 will be the amount at some times and places. Without being too minute, we have therefore to record the existence in the Underground Railway of an atmosphere more hurtful than that of the average of metalliferous mines.

Besides this, sulphurous acid, one of the evils absent from the mines, is found in the Underground Railway. One volume in 23,000 we consider very high, if we accept, on Dr. Letheby's authority, that 1 in 100,000 would create coughing.

As to carbonic acid, the amount in London streets is less than 4 in 10,000. 18.7 is high for the Underground Railway, although Dr. Letheby is right in saying that crowded rooms contain sometimes more than this.

If we look at the analyses of Drs. Letheby, Bachhoffner, and Whitmore, we observe results different from those of Professor Rodgers. They do not give the oxygen, but say that sulphurous acid to the amount of 1 in 100,000 could not be detected. The carbonic acid found was

about 5, although it rose in one case to 9, and in another to 12.7 in 10,000. It is, moreover, worthy of remark that only where the carbonic acid is low are the maximum and minimum shown. In all cases where the quantity exceeds 5.5 parts in 10,000, the air was taken when it was likely to be foulest (4 p.m.) and the *mean* only is given. An explanation why the *maximum* was not given in these cases is certainly due to the public. The oxygen is said not to be deficient, but results are wanting.

We have here two views of the case not agreeing very well with each other, although not in all points contradictory. Both, however, agree in drawing conclusions favourable to the air of the railway. For ourselves we are unable to draw any such satisfactory conclusions; the analyses are not clear. Are we to look on the average air as containing only five or six parts of carbonic acid per 10,000, or are we to consider that it has lost 7 or 8 tenths of a per cent of oxygen, which would indicate a larger amount of carbonic acid? Or, again, are we to believe that there is too little sulphurous acid to do injury, or 5 times more than is needful to make us cough? All these questions still remain unanswered, and yet the Companies are believed by many to have made an excellent case.

If there is a loss of 0.73 per cent of oxygen, where has it gone? We do not find it accounted for either in the amount of carbonic or sulphurous acid.

We do not say that this proves the analyses to be incorrect, because the air might have been collected separately for the two analyses, but it certainly proves insufficiency of evidence. The public ought not to be troubled with these discrepancies; the results ought to be laid before them clear and unquestionable: less than this implies imperfect work and deficient time. Chemical referees cannot fail to come to identical results if they work well and long enough.

We can see little good in partially corroborating evidence, or in opposing it with contradiction enough to admit of doubt. The question is not pushed to the utmost, and the public will think exactly as before. And what does it think? Why, that the air is really very bad, and that if chemists have failed to prove it so, so much the worse for the chemists, but the air is no better for all that. They think too that they care little for averages, because a traveller by the Underground Railway does not breathe there a mere average, but at times a real blast from the chimney, in an atmosphere already vitiated. What is the amount of carbonic or of sulphurous acid in that blast? That depends on the coal, and is easily calculated. They will believe, too, that although the air may not be capable of killing a strong man, it is less capable of supporting vitality than the air outside, and it is deadly to those who cannot bear so much impurity, exactly as the air even of London is to those who are so constituted that they must live in the country. To take a delicate organism as an instance; will anyone say that a lark could live in such air as was found? We cannot name the point at which the quality "deadly" begins; it is a matter of degree. There is no doubt that the air is of an inferior description, how bad we do not exactly know; but if it were really desired to be ascertained, numerous experiments should be made, and when there was a diversity of opinion we would have the matter investigated till every point was clear. It does not amount to a scientific inquiry when two sides throw down the dice and shout immediately who has won. The first experiments are generally useful merely to show the difficulties. Time and money are spent in obtaining scientific reports, and again more time and money in obtaining reports to contradict them; but the next step, namely, insisting that they shall agree, is too seldom taken. In this case they do agree in conclusions, we think without sufficient reason.

Perhaps in this case some of the weakness arises from a desire to protect the Company. It would be unwise to blame that body as if its conduct were reprehensible. The Directors must desire pure air more even than the public

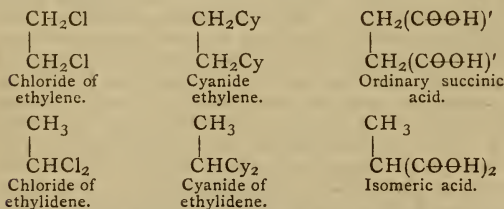
desires it, as it would increase both the comfort of the public and their profits. It shows great weakness on the part of the Company to appear at all afraid, or to seek to defend itself. It is enough if the Directors have done their best, and are ready to improve as soon as a method is shown them. The railway is too valuable to be without defenders, and the appointment of persons by the Company to conduct the examination for them weakens their case in the eyes of the public. However honourable these men are, the public will say—"The Directors after blowing smoke into our nostrils, attempt to throw dust into our eyes." It would be far better for them to make no defence at all, but improve the air of the tunnels to their utmost, never resting satisfied until the public ceases to complain.

ON THE FORMATION OF SUCCINIC ACID FROM CHLORIDE OF ETHYLIDENE.

By MAXWELL SIMPSON, M.D., F.R.S.

SOME years ago,* I ascertained that when bromide of ethylene is successively treated with cyanide of potassium and caustic potash ordinary succinic acid is formed. This reaction has since been confirmed by M. Geuther,† who, however, employed chloride instead of bromide of ethylene.

It occurred to me that it would be interesting to ascertain whether the chloride of ethylidene would, when subjected to the same treatment, produce the same or an isomeric acid. One would naturally be inclined to expect the latter result, seeing that the constitution of the chloride of ethylidene is different from that of the chloride of ethylene. The following formulæ will make this intelligible, and show the probable constitution of the isomeric acid:—



It is to be observed that, in the transformation of cyanide of ethylene into ordinary succinic acid, the group COOH takes the place of each equivalent of cyanogen. In the transformation of cyanide of ethylidene, it is to be supposed that the cyanogen is replaced in a similar manner, an isomeric acid being formed.

In order to determine this point I made the following experiments:—

A mixture of one equivalent of pure chloride of ethyle *chloré*, which is identical with the chloride of ethylidene, two equivalents of pure cyanide of potassium, and a large quantity of alcohol was exposed in a sealed matrass for twenty-seven hours to a temperature ranging between 160° and 180° C. I had previously ascertained that a high temperature was necessary in order to determine the reaction. At the expiration of this time the matrass was opened and its contents filtered. The filtered liquor was then treated with solid potash and afterwards exposed to the temperature of a water-bath till ammonia ceased to be evolved. When this was observed the alcohol was distilled off, and nitric acid added in excess to the residue. Finally this was evaporated to dryness at a low tempera-

ture, and the liberated organic acid taken up by alcohol. By dissolving in absolute alcohol and crystallising from water, it was obtained quite pure. The quantity I obtained was small; dried at 100° C. it gave the following numbers on analysis:—

Theory. Succinic acid.			Experiment.
		Per cent	
C ₄	48	40.67	40.86
H ₆	6	5.10	5.55
O ₄	64	54.23	
	118	100.00	

It had, therefore, the composition of succinic acid. That it was the ordinary acid was sufficiently proved by the following properties and reactions:—It melted at 179° C. and sublimed in the form of needles on the application of a higher temperature. The vapour produced, on being inhaled, instant coughing and a painful sensation in the nostrils. The neutralised acid gave an abundant brown precipitate on the addition of perchloride of iron. This test was tried both before and after the body in question had been treated with nitric acid, and with the same result.

The only explanation I can give of the formation of ordinary succinic acid in this case is, that the chloride of ethyle *chloré* was, in presence of the cyanide of potassium, partially converted by the high temperature to which it had been subjected, into chloride of ethylene, one equivalent of hydrogen changing its place with one equivalent of chlorine—



Since the above was written, I perceive that M. Wichelhaus‡ has formed the isomeric acid from cyanopropionic acid. The difference between it and the ordinary acid is well marked. Its melting-point is 40° lower, and it does not, when neutralised, give a precipitate with perchloride of iron. These results correspond with the researches of M. Caventon, who has shown that ordinary glycol can be obtained from the bromide of ethyle *bromé*.

The Star Shower of November 14th, next.—The geographical limits of visibility of the star-shower of 1866, coincide with the area over which the November meteors appeared in 1832. The latter shower was seen as far south as the Mauritius, as far east as Arabia and the Persian Gulf, and over the whole continent of Europe, with the British Isles, but it was not visible in America. It was, moreover, a moderate display, but it was followed, twelve months later in America, by the great storm of meteors which suddenly appeared on the morning of the 13th of November, 1833. The recent exhibition may therefore be regarded as the prelude of a similar meteor-rain in America, perhaps partially visible in Europe, as great and bright as the two star-storms seen in America, and partially visible in Europe, in the years 1799 and 1833. Unless unforeseen curvatures of the meteoric current disturb the geographical boundaries of the display, the first symptoms of the approaching star-shower will be perceived at day-break in England, on the morning of the 14th of November, 1867, when the light of the moon, then three days past the full, and of dawn appearing, will detract something from the numbers and brightness of the meteors. But the same oscillation of the curves in an opposite direction, it should be borne in mind, will bring Great Britain into full view of the centre of the shower, and make the principal spectacle of the meteors visible in Europe before day-break, as well as in America.—A. S. Herschel.

* Philosophical Transactions' for 1861.

† Annalen der Chemie und Pharmacie, cxx, p. 263.

‡ Zeitschrift für Chemie, Neue Folge, iii. Band, s. 247.

THE ATMOSPHERE OF THE METROPOLITAN RAILWAY.*

AN adjourned inquiry before Dr. Lankester, coroner for the central division of Middlesex, relative to the death of Elizabeth Stainsby, who died suddenly at the King's Cross station of the Metropolitan Railway on the evening of the 28th of August, was concluded on the 30th of October.

In consequence of a suggestion at a former sitting that the impurity of the air in the tunnels of the line might have accelerated the death of the person in question, the Coroner directed a scientific examination of the air of the various tunnels. The result of that investigation was now laid before the jury.

Mr. Hawkins, Q.C., and Mr. Myles Fenton, General Manager of the Metropolitan Railway, attended on behalf of the Company.

The CORONER reminded the jury that, according to the evidence of Dr. Popham, the young woman whose death they were investigating, had disease of the heart; but although a person suffering from that disease might be expected to die suddenly even under ordinary circumstances, the jury might very properly inquire whether any circumstance or condition to which the deceased had been exposed had accelerated death; and in the present instance it was more especially their duty to ascertain whether the condition of the atmosphere in the underground tunnels had had the effect of bringing about the deceased's death sooner than it would have otherwise occurred. Dr. Popham, who had made a *post mortem* examination, said in his evidence that he did not know sufficient of the nature of the atmosphere of the line to be able to say whether or not it had hastened death in this case. Although it had been said by some persons that the atmosphere of the railway really produced no other effect than the external air, there seemed to be a general feeling at the former sittings that the air of the tunnels was different in its quality from the air in the open street; and the question arose whether that difference was due to anything which would hasten the death of any person. For this reason it was determined that an analysis of the air should be made, and he had requested Professor Rodgers to make such an analysis. The railway authorities had been very anxious to get at the truth of the matter, and they had themselves employed some scientific gentlemen to make a similar investigation. He (the Coroner) must say that he regretted that in such cases as the present the Coroner had not a competent official assessor to instruct and assist him, for when scientific men were employed by the parties interested in these cases it often happened that they were supposed to advocate the interests of the side which had sought their services.

At the request of Professor Rodgers, the Coroner read his notes of Dr. Popham's evidence as to the *post mortem* appearances.

Mr. J. E. D. RODGERS was then sworn and examined. He said: I am lecturer on medical jurisprudence and toxicology at the London Hospital Medical College, and I lectured many years on Chemistry at the old St. George's School of Medicine. I am also a member of the Royal College of Surgeons, and Licentiate of Apothecaries' Hall. I have often been employed to give evidence at coroners' courts,—as much, I believe, as any toxicologist in England. I was especially so employed by Mr. Wakley. I hold the coroner's warrant for examining the air of the Underground Railway. I am acquainted with the fact that the illness of the deceased commenced at the Bishop's Road station. Dr. Popham has informed me that her stomach was full of food, and I have also been informed that the dress was remarkably tight round the waist.

The CORONER: We have had no evidence of that fact. Who undressed the woman?

Dr. POPHAM: I was present. The dress was certainly very tight—more than ordinarily so. I think it was I who cut the stay-laces. They compressed the lungs and chest a good deal. She had no belt, but she wore two dresses.

Professor RODGERS: I have carefully analysed and tested the air contained in the tunnels of the Underground Railway between the Bishop's Road and King's Cross stations. I have done this on four occasions—namely, September 4th, September 10th, October 2nd, and October 28th. With a view to compare the chemical constitution of the air of these tunnels with that of others, I have also subjected to experiments air taken from the Blackheath tunnel, the Gipsy Hill tunnel on the Crystal Palace line, the tunnel between King's Cross and Finchley on the Great Northern line, and the Box tunnel, the Wolverhampton tunnel, and the Birkenhead tunnel, on the Great Western Railway. I have also examined and tested the air of London in as pure a condition as I could obtain it, in order to ascertain the amount of deterioration that that of the tunnels had undergone. The atmosphere in a pure condition consists by volume of 79.19 measures of nitrogen, and 20.81 of oxygen, and every 10,000 measures of air contain from 3.7 to 6.2 measures of carbonic acid. On September 4th I visited the Metropolitan Railway between the hours of 3 and 5 p.m., and tested the general nature of the air, and collected certain portions for subsequent examination. In 17 cubic inches of air taken from each of the five tunnels between Bishop's Road and King's Cross, and tested for carbonic acid (with the exception of the air from the Gower Street and King's Cross tunnel, which contained a more notable quantity), only a slight trace of carbonic acid was indicated. The percentage of oxygen in the samples then taken was—

In the Bishop's Road tunnel	20.48
„ Edgware Road „	20.6
„ Baker Street „	20.3
„ Portland Road „	20.1

In the air of the tunnel between Gower Street and King's Cross, an opportunity having been watched to get some of the worst air, I found that the percentage of oxygen was 18.7. With this exception the air of the tunnels was not far below the external atmosphere as far as its oxygen was concerned. In travelling backwards and forwards the atmosphere between Gower Street and Portland Road was occasionally unpleasant, but still I felt no faintness or exhaustion from it. On my next visit, September 10th, between the hours of 10 and 11 p.m., I made an arrangement by which I could determine the quantity of carbonic acid and sulphurous acid contained in 775 cubic inches of the air taken from the tunnels during my transit backwards and forwards from King's Cross and Bishop's Road. The result was that the average sample of air contained 13 measures of carbonic acid in 10,000, and one measure of sulphurous acid in 40,789—nearly 41,000. On this occasion also the air taken from the Gower Street and King's Cross tunnel gave clear evidence of the presence of carbonic acid in 17 cubic inches. On my next visit, October 2nd, my object was to ascertain the quantity of carbonic and sulphurous acids in the air of the Gower Street and King's Cross tunnel only, and I found 18.7 measures of carbonic acid in 10,000, and one measure of sulphurous acid in 23,913.

The CORONER: You were getting worse then?

WITNESS: Rather worse. Then I had the air of that one tunnel in its worst possible condition. On my last visit, October 28th, I tested the air in all the tunnels between the hours of 8 and 9 p.m. and found traces of carbonic acid evident in the 17 cubic inches, the air of Gower Street, on this occasion containing the minimum, and that of Portland Road the maximum. I brought away samples for the purpose of ascertaining the per-

* Specially reported for the CHEMICAL NEWS.

centage of oxygen, and the results of my analysis I will now give you.

Percentage of Oxygen on October 28.

In Bishops Road tunnel	20.5
„ Edgware Road „	20.2
„ Baker Street „	20.5
„ Portland Road „	20.0
„ Gower Street „	20.4

On October 2nd I found in the Gower Street tunnel the percentage of oxygen was 20.1.

The witness then submitted the following results of observations, which, for the sake of comparison, he had made on the air of different railways:—

Percentage of Oxygen in Air.

Blackheath tunnel (Sept. 28th),	20.0
Crystal Palace tunnel (Oct. 2nd), taken in the midst of traffic	19.7
King's Cross and Finchley tunnel	20.5
Box tunnel	20.3
Birkenhead Tunnel	20.1
Wolverhampton tunnel	20.3
Open air of Pimlico (Sept. 21), going from Battersea Park by the S. W. Railway	20.9

The CORONER: Is that the general average?

WITNESS: To get the exact determination of oxygen in the air is a matter of considerable difficulty. It would take perhaps many months to determine it exactly.

The CORONER: But that is in accordance with general analyses?

WITNESS: It is. My object in making these analyses was fairly to contrast the air of the metropolitan tunnels with that of other situations and other tunnels. The highest point of carbonic acid which I found is 18.7 measures in 10,000. That occurred in the Gower Street and King's Cross tunnel. That is the worst quantity on that line. I must here observe that the quantity of carbonic acid in different airs has been determined by other observers. Dr. Roscoe found that in the atmosphere of a crowded theatre four feet above the stage there was no less than 23.37 measures of carbonic acid in the 10,000; and going a little higher (34 feet from the stage) he found 32.12 measures in the 10,000. In the Wellington Barracks it was determined that 2 feet 6 inches from the floor there were 12.42 measures of carbonic acid in the 10,000.

The CORONER: Have you found any fluctuation with regard to the sulphurous acid?

WITNESS: No, I have not.

The CORONER: Do you think the deficiency of oxygen likely to act injuriously upon the health of delicate persons?

WITNESS: Only if they continued there for some time. Not if they passed rapidly, as they do in the trains.

The CORONER: After all, the deficiency of oxygen appears to be very slight?

WITNESS: It is a very slight deficiency.

The CORONER: Except in that one case of Gower Street, where there was only 18 per cent.

WITNESS: At that time there had been trains rapidly passing, and there was one passing at the time I took the air.

The CORONER: You do not think, then, that the deficiency of oxygen would hasten the death of a person who had already constricted disease of the aorta?

WITNESS: I would answer that question in this way, Mr. Coroner. She has diseased heart; she has eaten considerably; she is tightly laced; she begins to be faint at a station where the air is unexceptionable—that is, at Bishop's Road. I do not think that under those circumstances the deficiency of oxygen hastened her death.

The CORONER: I will just say to the jury (I do not know whether they understand it) that the deficiency of oxygen is one point to be considered. But here are also two other things,—a redundancy of carbonic acid, and also the presence of a gas which, I suppose, does not

exist in the atmosphere at all, namely, sulphurous acid [To the witness]. With regard to the carbonic acid, do you think that that gas would be likely to act injuriously upon a person under those circumstances?

WITNESS: Not in the quantity found. It must be borne in mind that under an attack of that kind the respiration would be more feeble, and consequently less air would be taken in, and it would be more slowly taken in.

The CORONER: Then there is the sulphurous acid. Would that be likely to produce any injurious effect?

WITNESS: No, not in that quantity. The proportion would not be so great as if an ordinary sulphur-match containing a few grains of sulphur were burned in this room?

Q. Did you perceive the odour of sulphurous acid gas there?—A. In the Portland Road and the Gower Street tunnels, and occasionally on the passing of some of the trains.

Q. What was the highest quantity that you found of sulphurous acid gas?—A. In the Gower Street tunnel, 1 in 23,000.

Q. And you do not think that would be more than would be given by a match lighted in this room?—A. That would be rather more.

Q. There are about 3,000 cubic feet in this room. Now, if found in that quantity would the sulphurous acid produce any feeling of depression upon persons subjected to its effects?—A. I think not.

Q. Then when persons feel this gas so oppressive, do you think that arises from any peculiarity or idiosyncrasy in them, or is there more gas at those times?—A. It might arise from more gas at those times and the heat.

Q. You think there may be more sulphurous acid gas at one time than another? A. Certainly.

Q. Supposing, then, there is less oxygen, more carbonic acid, and more sulphurous acid, at one time than another, do you think there is sufficient ventilation to prevent dangerous results? A. I think that during my last two visits, there was unquestionably sufficient ventilation to prevent such an accumulation of those gases as would be injurious to the public health.

Q. You would not mind going up and down any number of times a day? A. No.

Q. Have you seen any of the servants of the railway at all, and questioned them as to the effect of the air upon them? A. Yes. They made no complaint.

Q. They all knew you were examining for the Coroner's court? A. They did; and I would here mention that I have had every facility given to me so that the examination should be perfect.

Q. Would you mind staying all day in one of those tunnels if you were handsomely paid for it? (Laughter) A. Oh, that becomes another question.

The CORONER: I really want to know what is your opinion with regard to the effect of the air upon health. There is a very decided feeling that persons suffer from it. I have had a high pile of letters about it, and amongst other things it is stated that servants of the Company have suffered and gone away. I want to get your opinion as to whether they would be likely to suffer, and to test in your own person whether you would like to stay in those tunnels all day long for a handsome sum.

WITNESS: My opinion of the air is that it is not an air that you would choose for a dwelling, to be constantly residing in. But I speak of the line simply as a tunnel for travelling; and, comparing it with other tunnels and crowded places, I think that the air of the Metropolitan Railway tunnels will now bear comparison with any. It is not an air that ought to be chosen as one to dwell in constantly.

Mr. HAWKINS: You would not take the air of this room to dwell in?

WITNESS: Certainly not.

The CORONER: Can you tell the jury whether it is

known that sulphurous acid has an injurious effect upon health?

WITNESS: Long continued exposure to it unquestionably has. I recollect the experiments of Dr. Turner and another on the influence of sulphurous acid on plants. The mixture in that case was much stronger, being one part of sulphurous acid in 5,000. That atmosphere killed plants. They withered in twenty-four hours. That points to the injurious effect of burning gas in greenhouses. I do not think that animals are so susceptible as vegetables to the effects of sulphurous acid. I do not think that in the hot summer weather, when there is less interchange of air between the tunnels and the outside atmosphere, there would be more carbonic and sulphurous acids and less oxygen than in the months when I examined the tunnels. It seemed to me that the trains passing backwards and forwards ventilated very completely and caused a change of air. I do not think that the tunnels would be more oppressive in hot than in cold weather, because the temperature of the air in the tunnels is rather lower than that of the external air in the summer, and rather higher in the winter. There would always be a difference. When I made my experiments the temperature of the air was 72 outside the tunnels and 69 inside. I cannot say whether there had been any removal of the glass or the windows at Baker Street and Gower Street stations before I took the first atmosphere, which was on the 4th of September. Unquestionably the removal of that glass would make a difference in the ventilation.

A JUROR: I should like to know whether the tests were made in a compartment similar to that in which the deceased died.

WITNESS: I do not know in what class she travelled. For the purpose of convenience I travelled in a third class carriage.

At the request of the Coroner, the witness exhibited and explained the apparatus which he used for the purpose of testing the air. It consisted of three small flasks connected by tubes and communicating with a large bottle of water to which a syphon was attached. The flasks contained baryta in solution; and the tubes were so arranged that when water was drawn off by the syphon from the large bottle, a corresponding bulk of the external air would enter at the flask most remote from the syphon, and pass consecutively through the two other flasks and ultimately into the large bottle, there taking the place of the water drawn off by the syphon. The bulk of the water so discharged was equal to that of the air passing into the flasks. The bottle was of known capacity, and thus the experimenter knew how many cubic inches of air he operated on.

Mrs. ANNIE PEMBRIDGE, who was in the railway carriage at the time the deceased was taken ill, deposed that she did not feel the air of the tunnels oppressive on that evening, and she heard no one complain of its being so. The carriage was a third class. Witness entered the carriage at Portland Road. The deceased was already there. Witness did not hear the deceased say, "What a stink!"

The CORONER asked if any stranger in court wished to give evidence as to the condition of the tunnel atmosphere, but no person came forward for the purpose.

Drs. George Henry Bachhoffner, Henry Letheby, and John Whitmore were then sworn. They presented in evidence a printed copy of a joint report of an examination of the air of the tunnels made by them at the request of the Directors of the railway.

The report was read by Mr. HAWKINS, and was as follows:—

Report of an Examination of the Air in the Tunnels of the Metropolitan Railway.

Having received instructions from the Directors of the Metropolitan Railway Company, through Messrs. Burchell, their solicitors, by letter addressed to Dr. Bachhoffner, to examine and report the state of the atmosphere in the

different tunnels on their line, and on the sanitary condition generally of the stations and tunnels, we beg to present the following as the result of our investigations:—

We proceeded in the first instance to obtain samples of the air in the tunnels, and we collected them on three separate occasions, namely:—First, immediately after the trains had ceased running at night; secondly, just before they commenced running in the morning; and, thirdly, in the afternoon between 4 and 5 o'clock, the period of the day when there is generally the largest amount of traffic.

The samples, twenty-eight in number, were taken at different places in each tunnel, and at different altitudes; some near the crown of the arch, some near the ground, and others on a level with the heads of the passengers. These samples were analysed for sulphurous acid, carbonic acid, carbonic oxide, coal gas, and oxygen.

The presence of sulphurous acid was sought for by the most delicate chemical test with which we are acquainted; namely, its action upon iodic acid and starch, which we have ascertained is capable of showing the presence of one part by volume of sulphurous acid in 100,000 parts of air, but we could not in any case discover by such test the presence of this acid; from which we conclude that its volume was less than the above in the tunnels. The proportion of carbonic acid by volume in 10,000 parts of the air in the several tunnels and stations was as follows:—

		Max.	Min.	Mean.
Tunnel between Bishop's Road and Edgware Road.				
2 a.m. Sept. 3.		4'1	4'1	4'1
Tunnel between Edgware Road and Baker Street	1 to 3 a.m. September 3	5'2	4'3	4'8
	2 to 4 a.m. September 6	5'4	4'7	5'0
	4 p.m. September 7	—	—	5'7
Baker Street Station, 4 p.m.	September 10	—	—	6'2
Tunnel between Baker Street and Portland Road	1 to 3 a.m. September 3	6'0	4'6	5'1
	2 to 4 a.m. September 6	4'5	4'2	4'4
	4 p.m. September 7	—	—	6'9
Tunnel between Portland Road and Gower Street	1 to 3 a.m. September 3	6'0	5'1	5'5
	2 to 4 a.m. September 6	6'1	4'5	5'1
	4 p.m. September 7	—	—	12'7
Gower Street Station, 4 p.m.	September 7	—	—	5'7
Tunnel between Gower Street and King's Cross	1 to 3 a.m. September 3	5'4	4'4	4'9
	2 to 4 a.m. September 6	5'2	4'3	4'6
	4 p.m. September 7	—	—	9'1

The amounts of carbo-hydrogen (coal gas) and of carbonic oxide present were so small as to be barely discoverable by the most delicate processes of analysis. Lastly, we ascertained that the amount of oxygen in the air of the tunnels and stations was not in any case deficient.

These results prove that in no instance was the air found to be vitiated to any material extent, although it will be seen that the air taken in the afternoon was less pure than that taken at night. The researches of Regnault, Bunsen, and other eminent chemists, and more recently those of Dr. Angus Smith, show that what may be termed "model or normal atmospheric air" in cities and large towns consists in every 10,000 parts by volume of

Oxygen	2,096
Nitrogen	7,900
Carbonic acid	4
	10,000

It is the last constituent which when in excess renders the air impure, and, in proportion to its increase, so is the air made unfit for respiration. Experiments conducted by Dr. Bernays and Dr. Angus Smith have shown that in several of our London theatres at about 10 o'clock p.m., in many other places of public resort, and especially in some of our law courts, the quantity of carbonic acid in the atmosphere of those places varied from 10 to 32 parts per 10,000; and from the Army Report (vol. v. page 272) it appears that in some fairly-ventilated barracks at Aldershot the quantity of carbonic acid at midnight amounted to 6'42 per 10,000 of air, and at 5 p.m. it amounted to 7'59 per 10,000; and in Wellington Barracks, from 11'89 to 14'18. Even in the streets of Manchester, in foggy weather, it has amounted to 8 parts per 10,000 of air.

In order to determine the atmospheric conditions of these tunnels by comparison with the condition of the air in the tunnels of other lines of railway, we took samples

of the air from several tunnels near London; and from these, which we designate by numbers only, we obtained the subjoined results:—

Tunnel.

No. 1—4·7 Carbonic acid per 10,000 of air by volume.

"	2—12·1	"	"	"
"	3—4·6	"	"	"
"	4—4·3	"	"	"
"	5—7·8	"	"	"
"	6—4·5	"	"	"
"	7—5·3	"	"	"
"	8—4·3	"	"	"
"	9—4·2	"	"	"
"	10—5·1	"	"	"
"	11—4·3	"	"	"
"	12—4·2	"	"	"
"	13—4·6	"	"	"

Our inquiries were next directed to the quality and quantity of the fuel used in the engines, and to the mode by which its combustion is effected. The plan adopted (with which we cordially agree) is to diminish as far as practicable the combustion of the fuel during the passage of the trains through the tunnels and stations. The steam in the boiler is raised in the open air to a temperature and pressure which, by experience and daily practice, is found sufficient to work the trains through the tunnels; and, when the trains come again into open space, fresh steam is then generated sufficient to propel the trains through the next journey, when the process is again repeated; by which means the engine driver is enabled, when passing through the tunnels and stations, to close the fire-box and damper so as merely to keep the fire in such a condition that it may be easily revived at either end of the journey.

The evolution of the products of combustion is thus almost entirely confined to that portion of the journey when the trains are passing through the open spaces.

The coke is of a superior quality, being made from a coal which is known to be more than usually free from iron pyrites, and it is burnt in the ovens for twenty-four hours longer than the ordinary coke generally used upon railways. In addition to which a staff of eight men and a foreman are constantly employed in examining and selecting the coke so as to ensure that none but the best quality of coke is transmitted to London for the use of the Underground Railway.

To determine the per-centage of sulphur in the coke, thirteen samples were submitted to chemical analysis, and these gave an average proportion of 0·26 per cent of sulphur, which is about one-fourth the quantity found in ordinary coke. As regards the coke, therefore, we see nothing to which we can take exception, but, on the contrary, we are of opinion that the best available means are used for obtaining a fuel as free from deleterious matter as possible, in addition to which the combustion of the same is conducted with the view of preventing as far as possible the escape of offensive gases.

The presence of sulphur, or, more correctly speaking, of sulphurous-acid gas, in the tunnels and stations, which at times is appreciable both to taste and smell, more particularly on those days when the external atmosphere is unusually dense, must not be taken as an indication that this gas exists in dangerous quantities, for as little as one part of this gas in 100,000 parts of atmospheric air is strongly perceptible both to taste and smell; and paper moistened with a solution of iodic acid and starch becomes tinged with a blue colour when exposed for a few minutes to air having the above proportion of sulphurous acid. On several occasions we have exposed this delicate test to the air in the tunnels while passing through them, both in the carriages and on the engines; and although the quantity of air thus brought into contact with the test has been considerable, yet it has only been during

the time of active traffic that the test has shown the presence of sulphurous acid, and then in an insignificant degree. In addition to the above, we beg to point out another cause which communicates to the air, more particularly in the stations, a pungent smell, which, although disagreeable, cannot in the slightest degree be regarded as injurious to health; we allude to the partial combustion of the wood forming the breaks when acting upon the tires of the wheels in checking the speed of the train as it approaches the stations.

The number of trips made by the trains through the tunnels daily amounts to 358, of which 284 are by the narrow-gauge trains, and 74 by the broad-gauge. Each of the narrow-gauge trains occupies 20,000 cubic feet of space, and those of the broad-gauge 23,000 cubic feet. The length of time occupied by each train in passing through the tunnels and stations is ten minutes. There are numerous openings communicating with the external atmosphere above, amounting in the aggregate to 3,164 square feet, and distributed in the following manner: namely, Baker Street station, 1,362 square feet; Portland Road station, 863 square feet; Gower Street station, 939 square feet. The western end of the tunnel at Edgware Road opens into a large area called the yard, and at the eastern end of the tunnel at King's Cross an opening has been made directly into the atmosphere, 40 feet in width, in addition. By an extensive series of thermometric observation, we find that there is an average difference of about 1·7° Fahrenheit between the temperature of tunnels and that of the external atmosphere; the mean outside temperature being 70° Fahrenheit, while the air in the tunnels had a mean temperature of 68·3° Fahrenheit, so that it was 1·7° Fahrenheit colder than the external atmosphere. During the winter months this condition will possibly be reversed; but in either case their will be a rapid change of air by an ascending and descending current. Having regard to the cubical volume of the trains, the short time occupied by them in passing through the tunnels and stations, the large volume of air which they displace, and the increased impetus given to the horizontal movement of the air by the rapidity of their transit, we are of opinion that the vitiation of the atmosphere cannot be of a serious character, and this accords with the results of our analysis.

A careful inspection of the tunnels has also shown that they are well constructed, and are generally dry and free from infiltration of liquid or other matter prejudicial to health, with the exception of a portion of the tunnel between Portland Road and Gower Street; to this we directed the attention of Mr. Fenton immediately after our first inspection; and we are happy to be able to add that the defect was at once attended to, and is now in a perfect sanitary condition.

We find on inquiry that the general health of the employés is such as to afford unquestionable proof of the sanitary condition of the air in the tunnels. From a statement furnished to us by Mr. Fenton, it appears that the per-centage of sickness and mortality of these persons is considerably less than that of the employés on the Great Western Railway. To this fact we may add the results of our own personal inquiries, which fully confirm it, as many of the engine-drivers and guards have been in the service of the Company since the opening of the line. They are to all external appearance robust healthy men, and they have assured us that since they were first appointed they have scarcely had a day's illness.

(Signed) GEO. H. BACHHOFFNER, Ph.D., F.C.S., &c.

HY. LETHEBY, M.B., M.A. &c., Professor of Chemistry in the College of the London Hospital, and Medical Officer of Health for the City of London.

J. WHITMORE, M.D., &c., Medical Officer of Health and Chemical Examiner of Gas for the Parish of St. Marylebone.

Dr. WHITMORE stated, in answer to the Coroner, that the glass was not removed from the windows of the Baker Street station until after the first samples of air had been taken for examination. The numbers given in the report were the result of a large number of experiments made on the days stated.

Mr. MYLES FENTON stated that the glass from the Gower Street Station was removed at the beginning of the summer, and long before the death in question. The removal was not due to any complaint he had received. Had had no complaint of the atmosphere officially previous to the death. At the opening of the line when it was worked by the Great Western Railway Company, some of the porters were taken ill at the Portland Road station. The reason was that there was no special provision made for securing the most perfect coke, and the drivers were not so skilful in the working of their engines as they are now. When the Metropolitan Company took the working of the line into their own hands they took means to secure the best coke in the country. They believed they had obtained it, though at very great cost. The atmosphere of the line was as good as they could make it, and the proportion of sickness among their men was smaller than among the Great Western Company's men.

FREDERICK GIBBONS, an inspector on the Metropolitan Railway, stated that there had been no complaints of the air on the part of the men employed on the line since the Company had used their own engines and employed good coke. The train in which the deceased travelled was the last but two that night.

Mr. HAWKINS stated that twenty-five millions of people travelled by the line every year, and that seventy-two millions had travelled by it from the time of its opening.

The CORONER remarked that there was a slight discrepancy between the examination made by Mr. Rodgers and those made by Drs. Bachhoffner, Letheby, and Whitmore, with regard to the sulphurous acid present in the tunnel air. The latter gentlemen stated that they could not detect it at all.

Dr. LETHEBY said sulphurous acid could be readily detected when a large volume of the air was caused to play upon the test-paper; but when only 70 or 80 inches of air was collected, they in every instance failed to discover sulphurous acid. The nose, however, was more sensitive than any chemical test. One part of sulphurous acid in 100,000 of air would create coughing. Persons who had an irritation of the bronchial membrane and of the throat would be more susceptible of its effects than others.

The CORONER said that that would account for some persons complaining very constantly of the effect of sulphurous acid in the tunnels. The evidence on the whole had been very re-assuring to the public.

Dr. LETHEBY said that the smell of the wood-breaks, which became charred as the trains were being stopped, would be more evident to the passengers than the sulphurous acid. Probably the gas evolved at such times was what persons found most oppressive. It would be a carbo-hydrogen, and probably there would be a little acetic acid.

The CORONER: Would that carbo-hydrogen produce an irritating effect?

Dr. LETHEBY: Yes. When wood is submitted to heat it gives off vinegar and an empyreumatic oil which is very irritating.

The CORONER: It has an irritating effect upon the mucous membrane of the lungs?

Dr. LETHEBY: Yes.

The CORONER: Do you think that any person with congestion of the lungs, we will say an abnormal congestion from disease of the heart, would be likely to feel this?

Dr. LETHEBY: There is no doubt there is a difference in the sensibility of the nerve of smell, and also in the sensibility of the mucous membrane of the lungs; but

although there may be differences in the recognition of it, I do not think that under any circumstances there would be sufficient to produce any dangerous effect.

The CORONER: The differences amongst persons in perceiving it will account for some persons telling me that they have been obliged to give up travelling by that line in consequence of a sense of irritation after leaving the train.

Dr. LETHEBY: I have calculated the quantity of sulphurous acid which would be given off by the burning of the coke now used, and I find that if they were to shut the tunnels up from end to end, the burning of the coke for 18 hours would not produce enough sulphurous acid to be dangerous to the most susceptible persons. Sulphurous acid is used as a disinfectant in a much larger proportion than would be present under such circumstances. It enters into the composition of a disinfectant which is used over and over again, and I have never heard of any bad effect from it.

The CORONER: And you know there are cases in which persons live in an atmosphere pervaded by it, as at Luton, where they bleach straw by it, and at other places.

Dr. LETHEBY: Yes, and it is used also for bleaching blankets.

The CORONER: How much coke is consumed in the tunnels a day?

Dr. BACHHOFFNER: Two tons.

Dr. LETHEBY: The coke contains 0.261 per cent of sulphur. 6lbs. of coke are consumed per mile in the tunnels and stations. The length of the tunnels and stations is 11,056 feet, that is 2.09 miles. The cubic contents of the tunnels (without the stations) is 4,606,792 feet. The number of trains passing up and down in the day of 18 hours is 358. If you work that out it will come to this,—that supposing the whole space to be hermetically sealed, and that the whole of the sulphur is burned in a closed atmosphere, the quantity of sulphurous acid produced by the sulphur of the coke in that cubic space of air will amount to 2.95 parts in 100,000 by volume. The sulphur burned amounts to 11.717 lbs. in the 18 hours. That will produce nearly 136 feet of sulphurous acid. That going into a volume of 4,606,792 cubic feet of air gives 2.95 parts of sulphurous acid in 100,000 volumes of air.

The CORONER: That is supposing no change of air during the eighteen hours?

Dr. LETHEBY: Yes. Well, I say that quantity is quite incapable of doing mischief.

In reply to the CORONER, Dr. Letheby stated that the apparatus he used for ascertaining the proportion of carbonic acid in the air was a contrivance of Dr. Angus Smith, invented for use in mines and crowded places where chemical apparatus could not be conveniently used. It gave quantitative results immediately. The apparatus consisted of an india-rubber ball of known capacity, by means of which the air to be tested was blown into a known quantity of baryta water. Account was kept of the number of ballfuls of air required to produce turbidity in the water, and the proportion of carbonic acid was ascertained by reference to a calculated table accompanying the apparatus. The air of the inquest-room was found to contain 44.4 volumes of carbonic acid in 10,000.

The CORONER: Well, we are very much worse than the tunnel, then. (Laughter).

Dr. LETHEBY: It is three times as bad as we have ever found it in the tunnel. (The witness then put in the subjoined table.)

Amounts of Carbonic Acid per 10,000 of Air in different Places.

1. *Cities and Towns—*

London	from 2.8 to 4.3	Average 3.4
Manchester	4.9 to 15.0	5.4
Munich .. ..	.. ..	5.0
Madrid	3.0 to 8.0	5.2
Paris	3.6 to 5.1	4.9

2. *Places of Public Resort*—

Court of Chancery (doors closed)	19'8
" " (doors open)	4'8
Chamber of Deputies, Paris	25'0
Theatres (London) .. 7'6 to 32	14'9
" (Manchester) 10'2 to 27'3	14'8
" (Paris) 23 to 43	33'0
3. <i>Dwelling-houses by Day</i> —	
From 5'4 to 12'7	7'8
4. <i>Dwelling-houses by Night</i> —	
In a study near table	11'8
" " near ceiling	15'6
Bed room at night	28'0
" " window open	8'0
5. <i>Dormitories</i> —	
At Saltpetriere	80'0
Another at ditto.	58'0
Workhouse Ward	125'0
Lodging-house in City	100'0
6. <i>Schools by day</i> —	
Various in France .. 27 to 47	36'0
" in Germany .. 20 to 56	39'2
" in England .. 9'7 to 31	21'5
7. <i>Mills and Workshops</i> —	
" .. 28'3 to 30'0	29'1
8. <i>Barracks at night</i> —	
" .. 11'9 to 14'2	12'8
10. <i>Cornish Mines</i> —	
Average of good	8'0
" of bad	190'9
11. <i>In Expired Breath</i> — 350 to 500	425
12. <i>In Room with Chafing Dish</i> —	1400

The CORONER asked Professor Rodgers whether he could account for finding so much more sulphurous acid than the other experimenters.

MR. RODGERS replied that both he and a gentleman who accompanied him had noticed that some of the trains which passed them seemed to emit no sulphur at all. He had not the remotest doubt of the accuracy of Dr. Letheby's experiments, but he must say that he (Mr. Rodgers) should not have found sulphur if it had not been there. He first obtained sulphite of baryta by means of the sulphurous acid in the air, and he afterwards converted the sulphite into sulphate by means of chlorine. He then estimated the quantity, and finally applied nitro-prusside of sodium as a test to show the existence of the sulphur compound. The weight of the sulphite subtracted from the gross weight of the precipitate showed the weight of the carbonate.

The CORONER: Do you see any objection to that plan, Dr. Letheby?

DR. LETHEBY: No; but there is a very small quantity to work upon.

MR. RODGERS: The balance I used turns at the thousandth of a grain.

The CORONER: Would the quantity of sulphurous acid you found do any harm.

MR. RODGERS: No.

The use of the iodic acid and starch test for sulphurous acid was then illustrated to the jury by Dr. Letheby. A decided blue tint was produced on the test paper by the fumes from a burning sulphur match.

The CORONER briefly summed up the evidence.

After a few minutes' consultation, the jury returned the following verdict: "That the deceased, Elizabeth Stainsby, on the 28th August was found dying, and did die, from the constricted disease of the aorta, and the jury say that the said death arose from natural causes."

M. R. Radau has just published a most interesting work on Acoustics (Paris. Hachette) with 114 wood-cuts; it contains the new experiments by M. Regnault on sound and kænigon vowels.

PROCEEDINGS OF SOCIETIES.

ACADEMY OF SCIENCES.

OCTOBER 28, 1867.

(FROM OUR OWN CORRESPONDENT.)

Osmogenic Extraction of Sugar.—The Pascal-Newton Forgeries.—Electro Capillary Researches.—The Nerves of Nerves.

M. PAYEN read a note on the employment in sugar refining of the osmogenic apparatus completed by M. Dubrunfaut, in order to separate from the sugars the crystallisable salts.

The molasses, which refuse to crystallise, contain in general fifty per cent of crystallisable sugar, half of which is recovered by the osmotic process. Osmosis is more profitably applied for eliminating the salts of the syrups obtained by the forced straining of the first and third portions of the crystallisation, which yield more syrup, and thus give results calculated to economise the apparatus crowded together in the works.

"M. Dubrunfaut," adds M. Payen, "has also found a method for the assay of raw sugars, which indicates not only the total quantity of sugar, but that of the mineral salts. One part of the saline residue of incineration corresponds, in the mean, to the formation of 7'45 of molasses containing 3'73 of sugar uncrystallisable as long as salts are present. This method is generally adopted at the present time.

A member of the Zollverein, relying upon the authority of Dr. Shreiber, recently declared that he had found by experiment that the salts in molasses, especially the nitrates and chlorides, did not hinder the crystallisation of the sugar. But in studying directly and separately the influences of the alkaline nitrates and chlorides, M. Payen has arrived at the following conclusions: nitrate of potash in various proportions, does not hinder the crystallisation of sugar, chloride of potassium exercises an influence in making the crystallisation slower, and chloride of sodium acts in the same way, but more powerfully.

NOVEMBER 4, 1867.

M. Arthur Chevalier deposited a sealed packet containing the description of a new apparatus.

Sir David Brewster, responding to the appeal of M. Chasles, has asked Lord Portsmouth, Lord Macclesfield, and the Director of the British Museum, if in the collection of autographs in their possession there were not some traces of relations between Pascal and Newton, and the efforts made by Messrs. Winthrop and Robertson to purchase from the Chevalier Blondeau de Charnage the compromising documents which M. Chasles now possesses. The answer of Lady Macclesfield is negative; that of Lord Portsmouth has not yet come to hand, but Sir David, who has had for a long time in his hands the autographs which he possesses, does not fear to affirm also to the contrary. The Director of the British Museum recognised that his collections possess in fact a great number of documents from the cabinet of M. Desmaizeaux; that they form four great volumes, but that no correspondence is found between Newton and Pascal. Sir David, as we have foreseen, rushes into the conclusion that Desmaizeaux is the forger himself—Desmaizeaux, the intimate friend of Newton, who would have done him an injury, while he refused to Fontenelle, for his eulogium of Newton, and to many others, the documents relative to the relations between Newton and Pascal!

M. Chasles answered that he is glad of the declaration of the Director of the British Museum, for the comparison between the two series of manuscripts will certainly prove the authenticity of many of his documents, as, for example, those of Leibnitz, and he mentioned that all these papers are not from the Desmaizeaux collection. Many are from Msme. de Perier, Dreux du Radier, Madame de Pompadour, &c.

M. Chasles presented also four series of photographs taken by reflected or transmitted light. Four of these autograph letters demonstrate invincibly, according to the artist (M. Murcit), an ancient pupil of the Saint Barbe College, that the ink on the paper has really as ancient a date as the water mark, and corresponds to that on the letters.

M. Becquerel, sen., read an additional note to his electro-capillary researches. He shows definitely that—1. The alteration exerted on the sides of the capillary spaces between two liquids. 2. The electricity disengaged at the contact of these liquids in the capillary spaces. 3. The electric conductivity of the sides covered with liquid. He has happily modified his method of experimenting. Instead of forming the fissures in the tubes he fastens at their extremity a strong stopper very tightly fixed, made with filtering paper soaked in water; a platinum wire traverses the stopper and connects the two liquids together.

M. Trecul answered at great length, and we think victoriously, the objections made by the celebrated botanist, Shultze, to his observations on the laticiferous organs of plants.

M. Peligot read a *resumé* of his very long researches on the part played by soda in plants.

M. Charles Robin announced that M. Sapey had discovered the nerves of nerves, *nervi nervorum*, the existence of which was well known, but not well observed. He examined by a microscope the mucous membrane and found that they formed round each nerve so many fibrous nerves that enclosed a canal in which the nervous pulp was lodged.

M. Robin presented also, in the name of M. Blondcau, Professor of the Laval Lyceum, the result of the experiments made relatively to the action of induced electricity on the seeds of plants.

M. Edmond Becquerel communicated some curious experiments of M. Bouchotte, of the electrolytic power of the currents of the magneto-electric machine of the Alliance Company. When the current sent by the commutator is always in the same direction, the electrolytic power is that of 144 Daniell elements with sulphate of copper; but when the current is alternate, as in the production of the electric light, the electro-motive power is nil.

M. Duchartre communicated with great praise the curious and interesting experiments of M. Joseph Balsamo, Professor of Physics at the Royal Lyceum, Lecce (Provincia de Otranto) Italy, on the production by hybridation of new sorts of cotton. He has succeeded in the fecundation, one after the other, of long-staple, short-staple, &c. He has obtained interesting varieties, which, if they multiplied, would render great service to the industrial world. One of the principal aims of M. Balsamo was to create a species of cotton the maturity of which would be more advanced, and which would be proof against the autumn rains, which in the south of Italy form one of the greatest obstacles to the indigenous culture of cotton.

F. MOIGNO.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, NOV. 5, 1867.

Tar Water.—Leadén Electrodes.—Production of High Temperatures.—Father Secchi and the Roman Observatory.—Self-registering Barometer.—Paraffin Lubricants.

M. GUYOT, an apothecary in Paris, has made a sort of concentrated tar-water, which he calls tar-liquor, calculated to render great service to the medical world. The great advantage of this preparation is to be able to furnish water more or less charged with tar, according to the affection to be treated. This preparation is free from any quackery and has given the best results.

The employment of tar-water is of old date. The discovery of its medical properties is due to Bishop Berkley.

This intrepid missionary embarked at the end of the 18th century for Rhode Island. The ship, having remained becalmed for several days in the midst of the ocean, was attacked by a terrible epidemic which decimated the crew. Some of the sick, lying at the bottom of the hold, the prey to a terrible fever, burning with thirst, drank the bilge water of the ship which was impregnated with tar. It was well they did so, for all those who drank of the water were rapidly cured. Berkley, a skilful and profound observer, remarked at once that it was the tar water which cured them, and by drinking it abundantly himself he was preserved from the contagion. On his return to Europe he experimented incessantly, and hastened to publish to the world, in a very interesting volume, the virtues of tar-water.

M. Planté has forwarded to the Society of Encouragement a plan by which platinum electrodes can be replaced by leaden ones. A short time after, he proposed this substitution in order to prove the superiority of the secondary current produced with lead over the secondary current furnished by platinum. He showed to the Academy of Sciences, at the meeting of March 26th, 1860, the powerful effects obtained with a secondary pile with leaden plates of great surface. M. Leon Foucault wrote on this subject on 7th June, 1860:—

“M. Jacobi employed secondary piles in platinum, but M. Planté employed, almost at the same time, lead, as being preferable to platinum, not on account of the economy, but certainly by reason of the secondary reaction. And to show in a striking manner the superiority of lead for this purpose, M. Planté has constructed at very little cost a secondary pile of great power, which can become in the hands of physicists an instrument of value. Lead, flexible and supple, is found in commerce, laminated in thin sheets, &c. Experiments have proved that two simple leaden wires polarised were able to produce a sufficiently intense secondary current to destroy residual magnetism that could not have been neutralised except by a platinum battery of a great number of elements.”

On 13th May, 1861, M. Planté presented to the Academy of Sciences, in a sealed letter, the substitution of lead for platinum, in order to obtain a greater quantity of ozone in the decomposition of water by the pile. He subsequently, being attached to the establishment of M. Lenoir, when the process of round casting is carried on by electro-decomposition, essayed with perfect success cores of lead placed in the moulds.

By the invention of the copper soluble anode M. Jacobi has happily completed his discovery in electro-metallurgy.

By the employment of the insoluble platinum, M. Lenoir has been able to succeed in the galvanic reproduction, in a single piece, of solid objects.

Introducing in his turn the lead anode, M. Planté has made an important improvement in the same direction.

In metallurgical operations in crucibles, M. Douenne has succeeded in diminishing the length of the operation and reducing the cost of fuel without having need of more blast. It also completely does away with smoke. Steam, admitted in the form of a jet, is decomposed into the elements of which it consists, oxygen and hydrogen, by which the oxygen combines with the carbon and hastens the combustion at the base of the crucible: the hydrogen, disengaged, being in a medium of higher temperature, rises around the crucible, when it is burnt by the air. The necessary temperature of fusion is thus produced at the proper point by the combustion of the gases resulting from the excessive temperature.

We have received from our illustrious colleague, the Reverend Father Secchi, Director of the Observatory of Rome, and who has just quitted Paris to return to his post, a letter which grieves us much. We cannot forget that in 1848 his predecessor, Father Vico, author of some great discoveries, was driven from Rome by violence and went to live in America, for which place we procured for him a free passage! We hope that the same lot will not befall Father Secchi, and that he will be free to illuminate the

Pontifical Observatory with new discoveries. M. Francois Arago was also instrumental in the protection granted to the learned and excellent Father Vico, who died, not in America, but at London, 15th November, 1848.

M. Brequet, the well-known clock and scientific instrument maker, has exhibited at the Champ de Mars a new self-registering barometer called the *Barometrograph*, giving indications every six hours, by diagram, of the pressure of the atmosphere. It consists of four metallic boxes, the upper and lower of which are undulated (the usual aneroid barometer); a vacuum is made in each of these boxes separately, and they are attached to a chain the movement of which is four times greater than that of a single box for the same variation of pressure. A steel spring of great strength acts upon these boxes in a contrary direction to the atmospheric pressure, and communicates with an indicating lever. The registration is effected on a cylinder which revolves by means of an ordinary clock; it makes a complete revolution in a week and carries a glazed paper, which is covered with lamp-black by being held over the flame of a candle; the extremity of this lever, very fine and pointed, traces a line of variations in a white streak. The periods (4 times a day) are represented on the diagram by vertical lines, and the barometric readings by horizontal lines placed a millimetre apart, the arm of the indicator being so arranged as to mark the variations on the same scale as a common mercurial barometer. This instrument has none of the errors of the common aneroid barometer resulting from the great number of pieces, levers, articulations, gearing, connecting chains, and springs.

A new application of paraffin has been made by M. Monnet for lubricating machinery. The great difficulty was in procuring a lubricating substance that would not melt at a lower temperature than from 300° to 400° Centigrade, and cheap enough to be employed at Lyons on a large scale. Now, the class of paraffins furnishes a substance called melen ($C_{40}H_{60}$), insoluble in water, soluble in fatty oils, volatile without decomposition, and only boiling at above 370°, while at the ordinary temperature it has the consistence of wax, and floats freely on water. Its degree of softening at the temperature of the hand, from 15° to 20° C., is already sufficient to form between surfaces in contact a thin sheet of melen, and according as the heat increases the substance becomes softer until it acquires a complete liquidity which is uniformly kept up.

The following are the advantages arising from paraffin or melen lubrication:—

1. During the working of the machine the lubricating substance is very fluid, oily, and unalterable. The melenic particles, carried by the steam, clot together on the surface of the condenser, and can be removed without difficulty.

2. When the motion has ceased the paraffin remains fixed and becomes solid much quicker than lubricating oils commonly in use, which are fluid at ordinary temperature.

3. When the machine is set in movement, the paraffin adherent to the surfaces to be lubricated is melted at once, while the steam gives its heat to the mass of metal of the receptacle before it acts upon the piston. The high temperature of the elastic fluid soon equalises the temperature, and the fusion of the paraffin takes place.

F. MOIGNO.

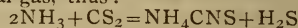
Death of the Earl of Rosse.—With regret we announce the death of the Earl of Rosse, who expired, after a lingering illness, at Birr Castle, King's County, on the 31st October, in the sixty-seventh year of his age. His name will always be associated with astronomical research and discovery, and with the gigantic reflector known by his name. He was President of the Royal Society in 1849, and he held the Chancellorship of the University of Dublin two years before his decease.

CORRESPONDENCE.

ON THE OCCURRENCE OF SULPHOCYANIDE OF AMMONIUM IN GAS MAINS.

To the Editor of the Chemical News.

SIR,—The existence of sulphocyanide of ammonium in gas mains, even at considerable distances from the gas works, is of very constant occurrence; and it is not carried by the gas, as Mr. Hart suggests in his paper before the Manchester Philosophical Society,* but is produced in the mains and service apparatus by the action of the ammonia in the bisulphide of carbon contained in coal gas, thus:—



This may at any time be proved by passing the purified gas supplied to the public through hydrate of lime, and soon, if ammonia be present, the lime will be found to be charged with more or less of sulphocyanide of calcium.

This reaction will account not only for the presence of sulphocyanide of ammonium in the water of all the hydrants and water meters of a district, but also for the ferrocyanide and sulphide of iron which are so commonly found in the iron mains.—I am, &c. H. LETHEBY.

College Laboratory, London Hospital, November, 5, 1867.

SILICEOUS STALACTITES.

To the Editor of the Chemical News.

SIR,—As a matter of curious interest I send you specimens of siliceous stalactites of peculiar origin. In the manufacture of "superphosphate" from phosphates of fossil or mineral character, a snow-like substance is abundantly deposited in the flues, &c. This is silica, and has its origin in the action of the sulphuric acid upon the fluoride of calcium present in the phosphates. Fluoride of silicon is given off as a gas, which is carried on with the dry steam, but when the latter becomes moist, is decomposed, giving rise to hydrofluosilicic acid and silica. For the first time in my experience this deposit of silica has taken the form now sent. Probably some of your readers may have met with better examples.—I am, &c.,

CHARLES F. BURNARD, F.C.S.

Nov. 2, 1867.

MISCELLANEOUS.

Royal Institution of Great Britain.—The following lectures have already been decided upon:—The Christmas lectures, adapted to a juvenile auditory, will be delivered by Professor Tyndall, LL.D., F.R.S. Subject—Heat and Cold. Professor Tyndall will also deliver ten lectures on "the Discoveries of Faraday." Professor Roscoe, F.R.S., will deliver eleven lectures on "the Chemistry of the non-Metallic Elements." George Scharf, Esq., F.S.A., will deliver six lectures on "Historical Portraiture of various Times and Countries;" and Professor Foster will deliver four lectures on "the Development of the Chick in the Egg." The Friday evening meetings will commence on January 17, when a discourse will be delivered by Professor Tyndall. After Easter, eight lectures in continuation will be delivered by Professor Foster on "the Development of the Chick in the Egg;" four lectures by Professor Odling, F.R.S., on "Chemical Combination;" and four lectures by Professor Bain, on "Popular Errors."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2549. F. Tolhausen, Boulevard Magenta, Paris, "An improved process and apparatus for instantaneously disinfecting faecal and manuring matters, improving the same, and also rendering them fit for feeding domestic animals."—A communication from L. J. B. A. Lemoine, and A. M. Turrel, Paris.—Petition recorded September 9, 1867.

2893. A. Aitchison, Wilton Terrace, Peckham, Surrey, "Improvements in the treatment of hydrocarbons for the production of gas sufficiently permanent to be stored for lighting and heating purposes, and especially in the treatment of the hydrocarbons and other products obtained by distilling or carbonising coal, wood, and other carbonaceous materials, including those obtained in the manufacture of gas and in the distillation of coal-tar.

2894. T. H. Baker, and T. Woodroffe, Tonbridge, Kent, "Improvements in treating sewage or other liquid matters so as to purify the more fluid portions thereof, and recover some of the contained matters for use in manufacturing processes, and in the preparation of others for use as manures."—October 15, 1867.

2918. J. Bannehr, Exeter, "Improvements in apparatus for supplying deodorising matter to dry or earth closets, and in processes of and apparatus for treating the liquid portion of human or animal excreta after removal from such closets or from other receptacles."—October 17, 1867.

NOTICES TO PROCEED.

1747. J. Onions, Devon Place, Newport, Monmouthshire, "Improvements in the manufacture of iron and steel."—Petition recorded June 15, 1867.

1886. C. O. Heyl, Berlin, "An improved method of and apparatus for making sulphuret of carbon."

1887. C. O. Heyl, Berlin, "An improved method of and apparatus for extracting fatty matters from and for scouring wool and other fibrous substances and textile fabrics, by the use of sulphuret of carbon, and for regaining the sulphuret used in such operation."—June 28, 1867.

1897. C. O. Heyl, Berlin, "An improved method of and apparatus for extracting oil or fatty matter from cotton or woollen waste, shoddy, mungo, rags, and analogous substances, by means of sulphuret of carbon."—June 29, 1867.

2011. W. E. Newton, Chancery Lane, "Improvements in the processes of and apparatus for the rectification and purification of alcohol."—A communication from J. G. Bequet, and H. Champennois, Rue St. Sebastien, Paris.—July 9, 1867.

2801. J. Anderson, Londonderry, "Improvements in obtaining chlorine, sodium, potassium, phosphorus, and their compounds."—October 5, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Comptes Rendus. August 26.

E. BLANCHARD, "Remarks on the Pascal Correspondence." CHASLES "Remarks on the Pascal Correspondence." REGNAULT, "Remarks on the Pascal Correspondence." BALARD, "Remarks on the Pascal Correspondence." CHEVREUL, "Remarks on the Pascal Correspondence." A. W. HOFMANN, "On a new Series of Homologues of Hydrocyanic Acid." FAUGERE, "On the Authenticity of the Pascal Correspondence." PRAT, "Researches on the Chemical Constitution of Fluorine Compounds, and on the Isolation of Fluorine." CHEVREUL, "Remarks on the Foregoing Paper." POOL, "Second Note on an Explosive Compound obtained by treating Glue with Chlorate and Nitrate of Potash." LEON, "On the Changes in the French Monetary Standards occasioned by the Introduction of the Decimal System. (Second Note)." LIPPMANN and LOUGUINE, "On the Synthesis of Di-Ethyl-Toluol." M. SIMPSON, "On the Formation of Succinic Acid from Chloride of Ethylidene." A. OPPENHEIM, "New Researches on the Isomerism of Protochloride of Allyl and Mono-chlorinated Propylene." J. CHMOULEVITCH, "Researches on the Influence of Heat on the Mechanical Work of the Muscles of the Frog." R. RADAU, "On a Self-registering Meteorological Apparatus invented by Magellan in 1782, and on the Theory of the Static or Steel-yard Barometer."

Bulletin de l'Académie Royale de Belgique (Classe des Sciences).

July 6, 1867.

KEKULE, "Report on T. Swart's Memoir on the Derivatives by Addition of Itaconic Acid and its Isomers." KEKULE, "Report on C. Glaser's Researches on some Derivatives of Cinnamic Acid (Part 2)." STAS, "Report on the two previous Memoirs." MELSENS, "Researches on Yeast and on the Fermentation of Beer." A. QUETELET, "On a Meteor observed on the 11th of June, 1867." A. QUETELET, "On a remarkable Thunderstorm at Ghent on the 2nd-3rd of June, 1867." T. SWART, "On the Derivatives by Addition of Itaconic Acid and its Isomers. (Part 2)." C. GLASER, "Researches on some Derivatives of Cinnamic Acid. (Part 2.)"

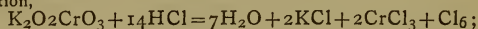
NOTES AND QUERIES.

Spontaneous Ignition of Charcoal.—Mr. Holmes will find this subject fully discussed in Dr. Taylor's "Principles of Medical Jurisprudence," published two or three years ago.—F.R.S.

Spontaneous Ignition of Charcoal.—In reply to "W. Holmes," an occurrence of this sort is certainly rare, but it is not unrecorded before. In the *Philosophical Magazine* for 1833 (vol. 3, p. 1.) a case is mentioned. In the same volume, p. 91, Mr. Davies attempts to assign the cause of the spontaneous ignition of charcoal. He suggests that during its manufacture a small quantity of potassium is formed, and adduces several reasons why this should be the case.—SCRUTATOR.

Storm Glass.—Will you allow me to ask Mr. Tomlinson for an explanation of the following, which I have often remarked in my storm glass? If it is left hanging up in my window undisturbed for a long time there gradually collects on the surface an oily-looking layer of a lightish brown colour, extending downwards faintly until it is lost in the pure white of the saline contents of the tube. If the storm glass be inverted, and the contents mixed up, the oily-looking liquid and the colour quite disappear, and some weeks elapse before they again make their appearance on the surface.—A CONSTANT READER.

Bleaching Palm Oil.—The want of success of your correspondent, Geo. Johnson, in bleaching palm oil appears to be at least partly due to his not using a sufficient quantity of hydrochloric acid. In order to complete the decomposition of one part of "Bichrome," 193 parts of HCl are requisite, the decomposition taking place according to the reaction,



but as the strongest liquid muriatic acid only contains about 40 per cent of HCl, and as the commercial acid is frequently much weaker, at least 4·8 or five parts of acid should be used for one of "bichrome," in order to obtain the whole available bleaching powder. In practice, a mixture of sulphuric and hydrochloric acids is frequently employed; about the following proportions have given good results: 1lb. bichrome, 4 to 5 lbs. yellow muriatic acid, $\frac{3}{4}$ to 1lb. sulphuric acid. Instead of agitating by paddles, air may be blown through the mass with advantage, as a better intermixture is thereby obtained, and labour saved; probably also the air assists in oxidising the colouring matter.

Sulphuric acid alone with bichrome has the advantage of not causing deleterious chlorine fumes, to the great comfort of the workman; it is, however, said to be less efficacious for some kinds of oil than the mixture of acids, and to require a longer time. The cheapest method appears to be exposure of the oil in a layer of about 1½ to 2 inches on the surface of water heated to 100° C. by steam to the combined influence of air and sunlight; it requires, however, a much longer time than the bichrome plan. By passing superheated steam, alone or mixed with air, at a temperature of 110° to 112° C. through the oil, the colour is almost entirely destroyed. Your correspondent will find further information in "Richardson and Watts's Chemical Technology," vol. i. part 2, p. 410; also in "Ure's Dictionary of Arts," &c., iii. 390.

In performing the bichrome bleaching process, the green liquid left after the first batch of oil has been bleached may be mixed with fresh bichrome, and a less quantity of acid than that first used added, and the whole used for a second batch: any bichrome left in the green liquor is thus utilised. By addition of excess of lime-paste to the spent chromic chloride, a precipitate of lime and chromic hydrate is obtained; this on drying and roasting with access of air furnishes a chromate of lime, which may be used instead of fresh bichrome, thus diminishing, with careful workmen, the cost of the process.—C. R. A. WRIGHT, B.Sc.

TO CORRESPONDENTS.

W. Schofield.—Received.

G. Johnson.—A letter is waiting at our office. Please forward, address where it is to be sent.

F. R. S.—The lecture appeared in full in the CHEMICAL NEWS, but was not published separately. We do not know the other works named.

T. Tyer.—We regret that we cannot give the information required. Hunt's Mineral Statistics would probably give what you want.

N. Thompson.—No other place except the one referred to.

J. Smith.—If you can send the No. of the CHEM. NEWS containing the lecture, the publisher will forward the copy.

Communications have been received from J. Thompson; H. Baden Pritchard; C. F. Burnard; J. Cliff; W. Spalding (with enclosure); F. O. Ward (with enclosure); A. E. Sansom; G. Griffith; D. Forbes, F.R.S. (with enclosure); J. H. Howard; T. Stevenson (with enclosure); R. M. Hands; W. H. Harrison; C. Manby; J. Forrest; Dr. A. E. Nordenskiöld (with enclosure); W. Schofield (with enclosure); F. Zeuner; J. Collins (with enclosure); W. Gibbs; S. Longman (with enclosure); Dr. E. Rohrig; W. Bremmer; Dr. R. Angus Smith, F.R.S.; W. Tobister; C. R. A. Wright; D. Day, F.R.S. (with enclosure); W. Hall; Professor Heaton; Dr. Letlicby; T. Bourne; T. Miller.

Books Received.—"A Peep at the Pyrenæes," by a Pedestrian. London: Whittaker and Co. "The Microscope in Geology," by D. Forbes, F.R.S. London: Hardwicke. "Undersökning af Selenmineralerna fran Skrikurum," af A. E. Nordenskiöld. "American Artisan." "American Journal of Mining." "Pharmaceutical Journal" for November. "Scientific Mining Press." "A Dictionary of Chemistry," Part 42, by H. Watts, B.A., F.R.S. London: Longmans. "The Industrial Partnerships Record," for November. "The Scientific American." "The World of Science." "Le Moniteur Scientifique." Paris.

THE CHEMICAL NEWS.

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THE CHEMICAL NEWS.

VOL. XVI., No. 415.

PRELIMINARY NOTICE OF

RESULTS ON THE COMPOSITION OF WHEAT

GROWN FOR TWENTY YEARS IN SUCCESSION ON

THE SAME LAND. (ABSTRACT.)

By J. B. LAWES, F.R.S., &c., and J. H. GILBERT, Ph.D., F.R.S.*

THE results had reference to the produce of a field in which wheat had now been grown, on some plots without manure, on one with farm-yard manure, and on others by different artificial mixtures, for twenty-four years in succession (1843-4 to 1866-7 inclusive). At the Cheltenham Meeting of the British Association, in 1856, the authors treated of the effects of season and manures on the composition of the crop as illustrated by the results of analysis relating to the produce of some of the plots during the first ten years of the experiments. At the Manchester Meeting, in 1861, they recurred to the subject; the analytical results, which then extended to the produce of some of the plots for sixteen years, were, however, chiefly applied to the illustration of certain points in connection with the exhaustion of soils. At the Nottingham Meeting, in 1866, they treated of the accumulation of the nitrogen of manure in the soil of the same experimental field. The results adduced on the present occasion showed the effects of season and manuring on the composition of both the grain and the straw during twenty years of the experimental growth.

The particulars of composition given are the percentages of dry substance, of mineral matter, and of nitrogen, and the constituents of the ash of both grain and straw, more than 200 complete ash-analyses being brought to bear on the subject; and, side by side with these, as indicating the general characters of the produce of the different seasons and plots, are given the proportion of corn to straw, and the weight per bushel of the corn.

In the case of the plots without manure, with farm-yard manure, and with ammonia-salts alone, every year, the ash of the grain last 16, or more, and of the straw of the last 16, of the twenty years, had been analysed; and in the case of 9 differently manured plots (including the above 3) the ash, of both corn and straw, of the first, the last, and two intermediate seasons (one bad and one good) of the last 12 of the 20 years had been analysed. It was the intention of the authors to publish the results of the investigation in detail before long; and on the present occasion they confined attention to a few of the most prominent effects of the respective manures on the composition of the crop, when thus applied for so long a continuance, year after year on the same plot.

It is first pointed out as remarkable, though fully established by their results from the commencement, that variation in manure, even though maintained for many years in succession, and resulting in great variation in amount of produce, affects comparatively little either the proportion of corn to straw, or the weight per bushel of corn, excepting, indeed, in a few extreme cases of abnormal exhaustion or repletion. Nor do the percentages of dry substance, of mineral matter in dry substance, or of nitrogen in dry substance, vary much under the direct influence of variation in manure, unless again in very abnormal cases. Very different, however, is the effect of season; the variation in the character of the produce, in every one

of the above particulars, being much greater in different seasons with the same manure than with different manures in the same season.

Consistently with these broad facts, the composition of the ash of the grain is found to be pretty uniform under a great variety of manurial conditions in one and the same season, only in a few extreme cases of special interest varying in any material degree. The same may be said in some, though in a much less degree, of the composition of the ash of the straw, which is obviously much more directly affected by the character of the supplies within the soil.

The general result is that (excepting in a few abnormal cases) the variation in the composition of the ash of the grain is limited to the slight variations due to differences of development and maturation, which, in their turn, are much greater with variation of season than with variation of manure. The composition of the ash of the straw, on the other hand, much more nearly represents the total mineral matters taken up by the plant, and much less the character of development of its own more fixed and essential constituents. In other words, whilst there may be considerable range in the composition of the matters taken up by the entire plant, the tendency in the formation and ripening of the ultimate product, the seed (whether produced in small quantity or large) is to a fixed and uniform composition, the deviation from which is little directly affected by the character of the supplies within the soil, but much more by the various influences of season.

The deviations from the point of fixed and uniform composition, thus due primarily to variations in climatic circumstance, are, however, when considered in relation to other characters of the grain, sufficient to show the general connection between the comparative predominance of individual constituents and that of certain general characters of development. A few illustrations were given; but the fuller treatment of the subject, in its bearing on these as well as on other points, was reserved until the results could be considered in the detail necessary to their proper elucidation.

One point of interest prominently brought out by the results relating to the composition of the straw-ash was, that a high percentage of silica was almost uniformly associated with a bad, and a low percentage with a good condition of the produce—a fact to which the authors had on former occasions called attention, but which, as was remarked by the President, was quite inconsistent with the generally accepted views on the subject.

VERIFICATION OF THE LAW OF HENRY AND DALTON

FOR THE

ABSORPTION BY LIQUIDS OF CARBONIC ACID GAS.

By M. KHANIKOFF.

THE absorption of gases by liquids was known to natural philosophers at the end of the seventeenth century; but the first important observations on this subject were made by Cavendish and Priestley.

At the beginning of this century, in the year 1803, Dr. Henry formulated a law of absorption of gases which is very simple—namely, he concluded from his experiences that the absorption is directly proportional to the pressure and inversely to the temperature. Nevertheless, it was evident that in the expression of the power of absorption possessed by liquids, in so simple a manner, the pressure and temperature could only be rough approximations, and that in reality a phenomenon so intimately connected with the molecular structure of the liquids could not be expressed in such an uncompounded form. For if this law were admitted without limitations, an unlimited

* Read in Section B at the British Association Meeting, Dundee.

absorption of gases must also be admitted,—already impossible for all gases, especially for coercible ones. Dr. Henry, by the nature of the apparatus that he constructed for his researches, could not come to any other conclusion. His apparatus consisted simply of a glass bell, in which he introduced the absorbing liquid and the absorbable gas. This bell was connected with a manometer by a tube of india-rubber, and after the establishment of the required pressure was separated from the manometer and shaken by the observer a long time, so as to produce the total absorption. This construction has two great imperfections—firstly, a pressure of more than three atmospheres forces the joint, and, secondly, the long contact of the hands of the observer with the vessel containing the gas, makes the temperature of the gaseous volume very uncertain, both before and after the absorption.

Saussure repeated the experiments of Dr. Henry without changing considerably his apparatus, and came naturally to the same result.

Nearly forty years after the experiments of Dr. Henry, M. Bunsen, of Heidelberg, made a valuable series of experiments on absorption of gases at different temperatures; but the ingenious apparatus he invented for this purpose could only be employed under the ordinary pressure of one atmosphere, and left untouched the relation established by Dr. Henry and Dalton between absorption and pressure. More recently, Messrs. Roscoe, Dittmar, and Simms have made very interesting investigations on the absorption of the gases of hydrochloric acid, ammonia, and sulphurous acid; they proved the law of Henry and Dalton to be only exact at an elevated temperature—viz., 40° Centig. for the sulphurous acid gas and 100° for the ammoniacal gas. For this reason my friend Mr. Longuimine and I resolved to undertake a new series of experiments on gases not so absorbable as those investigated by Messrs. Roscoe, Dittmar, and Simms.

Before all it was necessary to construct an apparatus which should not be liable to the above-mentioned imperfections of the apparatus of our celebrated predecessor, Dr. Henry. It was evident that it must consist of a glass vessel exactly gauged and arranged in a manner to be easily put in connection with a large manometer, and separated from it in a very short time. Secondly, the absorption must be produced, not by shaking the apparatus with the hands, but by moving it mechanically in a space with an invariable temperature.

The first question was easily solved by an iron tube with a cork, and the second by the observation that the contact of the absorbing liquid and the absorbable gas would be very perfect, by revolving the glass vessel containing the liquid and the gas in a great mass of water maintained constantly at the same temperature. These are the two principal differences between our apparatus and those of our predecessors, and without entering into more details on our experimentation executed at the College of France, in the laboratory of M. Regnault, and published in the last number of the *Annales de ph. et de ch.*, I pass directly to the results we obtained for the carbonic acid gas at the temperature of 15°.

If we designate by L , the co-efficient of absorption of a given gas under the pressure of P , and by L_2 the co-efficient of the same kind, but under a higher pressure P_2 , by the law of Henry and Dalton we must have,

$$L_2 : d = P_2 : P_1, \text{ or } \frac{L_2 - P_2}{L_1} = 0$$

But not only are these differences never *nil*, but they are constantly increasing with the pressure, so that this discrepancy with the law mentioned cannot be ascribed exclusively to the inevitable errors of observations.

From the moment that carbonic acid gas was liquefied it was evident that the co-efficient of its absorption by liquids must be *nil* for two different pressures, *first* for a pressure *nil*, or nearly *nil*, and second, for the pressure which reduced the gas at a given temperature to a liquid state.

It was evident also that the expression of a relation between the co-efficient of absorption and the pressure could not be a lineal function of this variable, but that this co-efficient α could be nearer expressed by the equation :

$$\alpha = A + BP + CP_2$$

For $\alpha = 0$,—the equation $A + BP + CP_2 = 0$ must have two positive and real roots, and also $\alpha = A \times BP - CP_2$ and $B \setminus A$, and $C \setminus B$. Applying to this equation for the different values of α and P , obtained by our experiments, the method of least squares, we found for A , B , and C , the following values :

$$A = \pm 0.01520946$$

$$B = \pm 0.01393995$$

$$C = \pm 0.00283004$$

The values being put in the equation $\alpha = 0$ gives us the two numerical expressions of P , which renders $\alpha = 0$, namely,

Atmos.

$$P = 0.10983 \text{ and } P = 6.1 \text{ at } 1439$$

The first of these two values is manifest, and requires no special commentary, but the second merits close investigation.

Our observations were made at the temperature of 15° Cent., and we have no direct experiment on the pressure necessary to coerce carbonic acid gas to a liquid at this temperature; but taking the observations of M. Regnault on the point of ebullition of the liquefied carbonic acid gas at different temperatures we obtain the following table :—

Temperature.	Pressure in Atmos.
73°3	1°8
56°7	5°3
40°0	11°3
28°9	16°3
12°2	26°8
1°1	37°2

so that the pressure increases for every degree of the Centigrade thermometer

In the first interval of 16°1 by 0 at 2,108
In the second „ of 16°7 by 0 at 3,473
In the third „ of 11°1 by 0 at 4,684
In the fourth „ of 17°7 by 0 at 6,287
And in the fifth „ of 11°1 by 0 at 9,369

so that without supposing that our last value of $P = 6.1$ at 1,439 is exact; but admitting only that for the interval of 16°1 coming next after 1°1, the increase follows the same law, this increase must be for every degree of the thermometer of 1 at 4,845.

But this value multiplied by 16.1 gives 23 at 23°9 + 76°2 = 61°1.

More importance than they deserve must not be attached to these numerical results, which cannot be strictly exact, being deduced from a too limited series of experiments.

I have mentioned them only to show that our method of experimentation can give us in a comparatively easy way—1st. The value of pressure required for liquefaction of gases; and, 2nd. The numerical value of the maximum of absorption varying only with the nature of the gas and with the temperature.

EXPERIMENTS WITH NITROGLYCERINE.

By C. A. RICHTER, of Freiberg.*

THE following is an account of the results of a comparison of the effects of nitroglycerine and the nitrate of soda gunpowder, which is used in this neighbourhood.

The first experiment was made under the guidance of one of the inventor's agents in the year 1865.

Beihilf shaft, which was being sunk 30ft. long by 8ft. wide, was chosen as a suitable place for the experiments.

* "Berg-und hüttenmännische Zeitung," 1867.

The shaft was being sunk in the "country" (*i.e.*, not on the vein), which consisted of hard grey gneiss, now and then only it had a few joints, which rendered the work easier. This happened to be the case on the day of the above-mentioned experiments, and partly explains the extraordinary effect produced by the nitroglycerine. The effect was indeed extraordinary, because boreholes, placed so as to give them twice as much to do as usual, and even more, did their work perfectly, and, indeed, more than sufficiently, for they caused such an accumulation of stuff in the shaft that for three days no more boring could be done, and the men had to devote themselves entirely to winding up the stuff. The holes were bored partly single-handed, and then one inch in diameter and 27 to 30 inches deep, partly by two men, and then two inches in diameter and 36 to 48 inches deep. The holes were charged in the mode originally adopted by the agent. As all the holes looked downwards, the nitroglycerine could be poured in by means of a tin funnel. Upon the top of it a small wooden cartridge, three inches long, containing a little powder, was let down by means of the Bickford's fuse to which it was attached, and then the hole was filled up by hand, without using any tool at all, first with mud and then with sand or small stuff.

It appeared from these first experiments with nitroglycerine that, without any exaggeration, its power was four or five times greater than that of the powder hitherto in use. From this it naturally followed, as the advantages of a powerful explosive material would be most felt in large workings in close little-jointed rocks, such as sinking a shaft in the "country," that such workings could be carried on much faster than had previously been the case. This advantage which nitroglycerine afforded could only be looked upon as most important.

Besides, other advantages were apparent, which, it is true, did not seem so great as the first, but which, nevertheless, promised to exercise a decidedly favourable influence on the economy of mining. They may be summed up as follows:—

1. Fewer men are wanted for working out a certain sized piece of ground, and fewer holes have to be bored than at present. A dearth of miners may to a certain extent be remedied in this manner, and less steel and iron will be used than hitherto.
2. Nitroglycerine does not take fire easily, and when lighted burns but does not explode, and goes out as soon as the flame with which it had been brought in contact is taken away.
3. The holes can be tamped easily, quickly, and without danger.
4. The amount of smoke after a blast is small compared with that of powder, and workmen can go back at once to the place where they have blasted without trouble. This is a considerable advantage in places where there is but little draught, and holes can be bored and fired singly, which was hitherto almost impossible in consequence of the all but impenetrable smoke, and had to be avoided as much as possible.
5. Holes that have missed or only partly torn can be retamped and shot off, which, with the present arrangements is either impossible or accompanied by great danger.

Against these advantages must be set the following disadvantages:—

- a. The gases formed during the explosion of the nitroglycerine have an injurious effect on the organs of sight and respiration.
- b. Nitroglycerine explodes on being struck smartly, and easily freezes.
- c. The masses of rock which it removes are mostly very large, and considerable time has to be spent in breaking them up.

With regard to the first of these disadvantages, it should be remarked that during the first day's experiments, scarcely any signs of pain in the eyes or head

were remarked, although the bottom of the shaft was not particularly well ventilated; later they grew more and more marked, so that it became gradually more apparent that where nitroglycerine was used every effort should be made to secure good ventilation. In the course of time, however, the workmen seem to have become accustomed to the smell, and this disadvantage of the nitroglycerine was no longer looked upon as one which need restrict its employment.

The dangerous property of nitroglycerine of exploding from a smart blow cannot be denied, but this is not more dangerous than the property of ordinary gunpowder of taking fire readily and exploding; and again, the fact of its freezing must be looked upon rather as an inconvenience than a danger.

We must allow that the last of the three disadvantages also exists; holes blasted with nitroglycerine throw down large masses rather than small. These may easily be broken up with a sledge, or, if necessary, be blasted. At all events, it is no greater disadvantage than what happens so often with powder; the rock is blown into small pieces, which are sometimes thrown to a great distance, and may perhaps do damage, not only to the workings but also to the miners. On the contrary, it would seem to be rather an advantage than a disadvantage that the rock should be thrown down gently and without danger, because the workmen, the timbering, and masonry are not so liable to be injured as in blasting with powder.

All the results of the first trials with nitroglycerine were so favourable, that they naturally instigated us to obtain further and more certain proofs of the possibility of practically employing nitroglycerine underground. A comparative experiment was made between the nitrate of soda powder in use here and nitroglycerine at Segen Gottes mine, in sinking a shaft, in driving a level, and in stopes. The nitroglycerine was tried first; 226 holes were bored, in all 5,043 inches (English) deep. Of these holes, 180, or 80 per cent, tore perfectly, 40, or 17 per cent, only half, whilst 6, or 3 per cent, did nothing. 9'302 cubic fathoms (English) of ground were removed; the smith's cost was £1 6s.; blasting materials cost 17s. 14d.; nitroglycerine, £11 11s. 6d.; wages, £23 12s. 9d.; so that the cubic fathom cost £4 0s. 4d.; the end, on account of its small dimensions, costing comparatively the most, and the sinking of the shaft, for the opposite reason, being the cheapest work. The experiment with the nitrate of soda powder was then made; 559 holes were bored, in all 9,249 inches deep, or 333 holes, with a depth of 4,206 inches more than in the previous experiment. 315, or 57 per cent, tore perfectly; 225, or 40 per cent, only half; and 19, or 3 per cent, not at all. By means of these holes, 6'036 cubic fathoms of ground were removed, in which the end and the stopes do not stand anything nearly so far behind as in the first case. The smith's cost was £1 18s. 2d.; blasting materials, 9s. 7d.; powder, £3 13s.; wages, £24 7s. 10d.; so that the cubic fathom cost £5 0s. 94d. With powder, therefore, 3'266 cubic fathoms less ground were removed, though the wages (in spite of one case of loss of wages) were 15s. 14d., and the smith's cost 12s. 2d. more; on the other hand, on account of using the needle in blasting, the blasting materials cost 7s. 64d. less; the powder also cost £7 18s. 6d. less than the nitroglycerine. Taking all together, the cubic fathom with powder cost £1 0s. 54d. more than it did with nitroglycerine.

These experiments show that the employment of nitroglycerine, especially in large workings, already offers great advantages over ordinary powder, and that these advantages lie in the fact that with fewer holes, and in a shorter time, a greater amount of ground can be removed than by the present mode of proceeding. Besides, in working out any given quantity of ground nitroglycerine is found to do the work much cheaper, on account of the extraordinary force with which it blasts the holes, and the smaller quantity of iron and steel used up. Lastly, the holes can be tamped much quicker and without danger, as if they are loosely filled with sand, any

small stuff, or even water, they can be considered as thoroughly well tamped. But even a stronger tamping, such as is in use in the Hartz, has, up to the present time, been entirely exempt from danger, and has doubtless caused a greater effect, under certain circumstances, as may be readily understood. In the Hartz, the cartridges, made of well-glued paper, are filled with sand in order to make them stiffer, and especially to allow their being longer, and thus to spread the explosive force over a greater area; in other words, to give the explosive force a greater leverage, and thus increase the effect. The proper quantity of nitroglycerine for each hole is then poured into the cartridge by means of a little can with a spout, until the sand is more than saturated, and the whole of the nitroglycerine forms one single mass; on the top a little sand is put so as to close the cartridges better, and then the upper part is pinched up just as in the cartridges filled with powder. Where nitroglycerine is used alone, without sand, the cartridges are made long and narrow for the reason explained above; they are closed with a cork. The cartridge in either case is carefully let down into the hole, or pushed in with the tamping bar, or scraper. Upon the top of it comes a paper cartridge, about two or three inches in length, not particularly strong, and filled with good powder, such as sporting powder: it has the ordinary iron needle stuck in it, but without the reed; a little clay is stuck on the top of the cartridge and round about the needle. The tamping employed is clay-slate beaten up fine, and made into a soft mass with water; this is moulded into lumps like pieces of peat, and when dried is ready for use. This tamping is forced in with the iron tamping bar, the wooden one being discarded; the first blows are gentle, and then gradually harder and harder until the mass rings. The hammer, however, is not used, the tamping is simply rammed in with the iron bar. When the hole is tamped it is clayed over, the needle drawn out, and instead of the reed filled with powder, a paper fuse is stuck in and the hole fired off.

The results obtained by the experiments described above would probably have been greater had the workmen been as thoroughly accustomed to the use of nitroglycerine as they are to that of powder. This may be inferred from the fact that far fewer holes were bored in the experiments where nitroglycerine was used than in those where powder was the blasting material employed. For though it must be conceded that holes blasted with nitroglycerine brought about more delay, and caused more time to be spent in winding stuff, and thus caused a loss of time, still the difference in the number of holes bored is so great that we may assume that the men would have bored more holes if they had had more experience in the mode of procedure adopted with nitroglycerine.

The same thing no doubt happened when gunpowder was first introduced, and probably less work could be done with it, and much more danger accompanied its employment, than has since proved to be the case.

In speaking of the many advantages which, according to these experiments, nitroglycerine possesses over gunpowder, it may be added that still further progress has been made with regard to its introduction, and people have not been stopped even by two accidents which have occurred from using it. In one case walls to keep up the attle heap were being built out of some large pieces of rock brought up from the Beihlif shaft, and which had been lying out in the air for some time. These pieces had to be trimmed a little with the hammer, and during this work a small explosion occurred, slightly injuring the mason in the eye.

The explosion was probably caused by some nitroglycerine which had escaped decomposition and remained sticking to the rock. In the second case a hole in the mine did not tear the rock properly but simply split and loosened it. As the miner was removing these loose pieces an explosion occurred from undecomposed nitroglycerine

which remained in the cracks. Luckily, the man was but slightly injured.

The accidents can only have occurred from the nitroglycerine having been used alone without any cartridge, or from the hole not having been properly clayed, so that the nitroglycerine found means of getting into joints and cracks and escaped decomposition. The consequence has been that nitroglycerine is not so often poured straight into the hole, but is enclosed in a cartridge of paper well joined with glue, and in order to give the cartridges greater strength, and the explosive material a greater area to act on, the cartridge is first of all filled up to a certain height with sand, or, as I have since tried, it is at once filled with common powder.

Now, although it has been remarked that a hole containing free nitroglycerine does more work than one in which the blasting oil is contained in a cartridge, which somewhat hinders the quickness of its decomposition, it must not be assumed that the real reason has yet been hit upon, and before a final decision further evidence must first of all be obtained.

Further experiments were made in the above-described manner in sinking a shaft in clay-slate. During a period of three months the men were paid for having worked 372 shifts, £13 15s. 9½d., or, adding in the money paid for extra work, £2 10 0½d., altogether £16 5s. 10½d. 251 holes, with a total depth of 7,520 inches, were bored, and 11,972 cubic fathoms of ground were removed. Of these holes 229, or 91·2 per cent, tore perfectly; 18, or 7·2 per cent, only half; and 4, or 1·6 per cent, simply blew out, but could be used again on being recharged. In each shift, then, '67 of a hole, or 20·2 inches were bored, and '0321 of a cubic fathom of ground removed, which cost 9d., or, including the extra wages, 10½d. The smith's cost was 9s. 4d.; blasting materials, 16s. 5d., and the expense of 99·67 pounds of nitroglycerine £17 18s. 9½d.; so that the total expenditure was £35 10s. 5d., or £2 19s. 3½d. per cubic fathom.

The results of these experiments are still more favourable than those obtained previously, and the reason of this lies in the fact that the experiments were confined to a shaft which was being sunk of greater length and breadth than the previous one, and consequently, the full effect of the nitroglycerine was obtained. The sinking of the shaft in question has been consequently continued with the aid of nitroglycerine, and with excellent results, for the holes do quite three times as much work as they did with gunpowder. The sinking of course proceeds more rapidly; the complaints about headaches caused by the nitroglycerine have ceased, and no other inconveniences have manifested themselves. It must not be denied that this favourable result is partly owing to the length and breadth of the shaft, the tight nature of the ground, as well as to the porous nature of the clay-slate, and the wetness of the sinking. Still some means should be discovered to lessen or prevent entirely the injurious effect which nitroglycerine has on the health of the workman. If further experience does not bring any other disagreeable qualities to light, there is no doubt that nitroglycerine will be more generally introduced in certain workings to which it is specially adapted, and then further improvements may bring about still more important results than those which have already been obtained in certain cases.

Sulphite of Uranid, Double-salts of.—L. Scheller. Pure oxide of uranid (uranid = $U''' = 240$) prepared according to Malaguti's method by heating an alcoholic solution of uranic nitrate and washing the residue, was suspended in water, and sulphurous acid gas passed through until all was dissolved. On adding to this solution potassic, sodic, or ammoniac disulphite, crystalline precipitates are obtained of the following compositions:—UK. HSO_6 , UNa. HSO_6 , and $UNH_4.HSO_6$. They are difficultly soluble in water, but dissolve readily in sulphurous acid.—(*Zeitschr. Chem.*, N.F. iii. 522.)

ON THE DEVELOPMENT OF IDEAS IN
NATURAL PHILOSOPHY.*

By JUSTUS VON LIEBIG.

THE history of natural philosophy teaches us that the final object of our knowledge of matter and phenomena is the material and intellectual requirements of mankind.

Nature has denied to man the means of resistance against external injurious effects which constantly endanger his existence; and it is in the first place the pressure acting upon him from without, which challenges his dormant mental powers to a combat. He gains from nature whatever he requires for the purpose, as a protection against the influence of climate and against his enemies, as a means of supporting life or restoring health, and thus originates the acquaintance with innumerable substances, and their qualities, and with the processes by which they are made suitable to his purposes. In a former lecture I took occasion to draw attention to the peculiar power of the imagination to call forth the relationship between different pictures raised by impressions upon our senses, and to draw inferences, which depend upon each other in a similar manner as the ideas which guide the understanding in its combinations, only with this difference, that the inferences of imagination are likewise pictures. A word taken as the sign of an idea is the same to the understanding, as an impression upon the senses to the imagination.

The word "tar" is very likely without the slightest reaction upon the imagination of most people, whereas the smell of ship's tar will awaken in the imagination of an individual the picture of a ship or a sea-port visited by him years ago.

The husbandman, the shepherd, the hunter, stand in direct communication with nature. The first learns by simple observation of the senses, how sunshine and rain act upon the growth of his plants, how the seed germinates and develops itself into a plant, how the latter blossoms and bears fruit; in the same manner the shepherd collects a mass of experience on the maintenance and propagation of the animals he tends, he becomes acquainted with their diseases, and through them with nutritive and venomous plants, he constructs himself a timepiece on the starry sky, he learns to know the course of the heavenly bodies and how they move with the seasons. The priest who dissects the animals of sacrifice learns to know their internal parts and their relative functions. A collection of such facts leads those who observe them to draw inferences about the existence of other facts. The shepherd searches for medicinal herbs for his animals, and applies them to man; from the changes produced by diseases in the organism of animals, the sacrificer draws inferences as to the nature of human diseases. Thus the shepherd becomes the first therapist, the priest the first pathologist.

The processes of manufacturing leather, soap, glass, wine, oil, bread, and cheese have been invented by deductions of a similar nature; they are very ancient, as are also the application of woollen and vegetable fibre to textiles, the art of dyeing, smelting of copper, tin and iron ores, the extraction of gold and silver.

The superiority of man over other animals chiefly depends upon his capacity to produce inventions which meet his requirements, and the sum total of these inventions in a population expresses the meaning of its civilisation. By means of the inventions of men in art and manufacture, in medicine, mechanics, and astronomy, those facts are acquired which are indispensable to the subsequent development of science; they lead to the knowledge of the phenomena of motion in the firmament and upon the surface of the globe, of the constituent

parts of the earth and of the animals and plants on the same; they lead to the discovery of the effects of fire and of the natural forces,—but the experimental science which leads to inventions, does not seek any solution of the nature and essence of matter and natural phenomena, for this is quite beyond its range. The scientific study of nature aims at different results; it springs from the intellectual requirements of man; from the impulse of his mind to account for the world in which he lives, and for the objects and phenomena which daily engage his senses.

Now, at the commencement of this inquiry, man does not know anything of the nature of his senses: not that the origin of things is inaccessible to them; the senses, intended to assist him in comprehending the outer world, are to him implements the handling of which he does not know; he sees and hears, but he knows nothing of light or sound, he does not know whether he looks with his eyes at certain objects or whether these objects look into his eyes, nor that the temperature he feels is his own.

History teaches us that the popular notions of substances and events in the outer world develop themselves much in the same way as the mind of a child, which becomes acquainted only gradually with the impressions of his senses. By continued and repeated testing things with the hand, the eye, or the tongue, the child learns to recognise and distinguish their shape, colour, and condition, the resistance offered, solid from the liquid, the cold from the warm, the dry from the wet; and the child's further development chiefly depends on his capacity to reproduce within himself the already observed without calling in further assistance of his senses. The pictures retained by memory gradually increase in number, and the human mind begins unconsciously to put questions to the senses; it compares and discovers analogies and distinctions; it notices that under certain conditions cold becomes warm, liquid solid, solid liquid; but a long time elapses before it learns the characteristics of every substance. The idea of motion connects itself with a hand which lifts, pushes away, or draws something towards itself.

With ideas of this kind the investigation of nature began, and its further expansion took place as in an individual, only the senses and minds of many participated in testing matter and in considering processes; every man takes his own point of view, every one observes in the object or phenomenon a different face and profile, and thus it gradually becomes known from all sides; later on, when the details become more distinct, many phenomena are found to have parts, to be compounds, and things are discovered to be present which escaped the simple observation of the senses, our former trust in the impressions of the senses is lost, and measures are adopted to prove their veracity.

In this manner we gradually succeed in acquiring of matter and of processes definite ideas which are applicable to mental operations; with their accumulation the number of their combinations naturally increases, as also the mastery of the mind over the senses;—instead of unconscious questions he now asks positive ones, instead of one a number of questions, the perceptions grow into conscious observations.

No one will maintain that in former times an obstacle had existed in the senses of men preventing them from seeing and perceiving everything in the same manner as we now see and perceive. Want of facts is also not the reason of the difference in our recent and former views of many phenomena; true, we now know more facts than formerly, but those relating to the most common phenomena—to air and fire, vapour and rain, heat and cold—were just as well known and observable to men a thousand years ago as they are to-day, and no one will imagine that before the discovery of oxygen people were the least doubtful as to the necessary presence of air for burning and respiration, or of a strong current of

* A Lecture delivered at the Meeting of the Royal Academy of Science, at Munich.

air for the production of high degrees of heat. Our better understanding does not lie in our senses nor in our higher mental capacity, for in regard to the latter the great philosophers of antiquity who endeavoured to gain information on the essence of matter and phenomena serve still at the present day as models unsurpassed.

The true reason is that we have grown richer in ideas; but the ideas of things, or, what is the same, the acquaintance with sense-observed things, their peculiarities and agencies, man does not bring into the world with him; they must be acquired by experience, must be developed in his mind in a totally different manner from the animal, whose faculties are developed to the highest perfection attainable without his co-operation, in consequence of natural laws acting within him.

All these conceptions originated with or sprang from impressions of the senses, and as natural phenomena are always composite, and their conditions or parts are again things which likewise produce definite and invariable impressions of their own, it is clear that a mental conception of a thing or phenomenon must include all these characteristics in itself.

We speak of carbon as a constituent part of plants and animal bodies, without calling to our mind either diamond, coal, charcoal, or lamp-black; the same with phosphorus or iodine, which as such do not even exist in nature. These are all abstract notions which once settled, raise in all cases where their characteristics are perceived, the idea of carbon, phosphorus, or iodine.

The natural phenomena are linked together like the meshes of a net, and the investigation of individual phenomena results in showing that they have in common certain conditions, which as stated above are active realities; and as the totality of the conditions or parts of all phenomena is limited and relatively small, we succeed at last in reducing all natural phenomena to conceptions.

This is the problem of science,—its progress depends upon the accumulation of facts, but it is not in proportion to their number, only to the sum total of mental material deduced from the facts. A thousand facts *per se* do not alter the position of science, whereas a single one which has become comprehensible outweighs in course of time all others in importance.

These views of the development of the ideas derived from experience, or, to use a shorter expression hereafter, of *derived ideas*, may perhaps assist in leading to a more correct estimate of the different epochs in the comprehension of natural phenomena than has hitherto been the case.

The explanation of a natural phenomenon being a logical process, our intellect is *à priori* enabled to lay down the proposition, *i.e.* the logical conditions, which must combine in its comprehension or explanation. This has been done by Aristotle, who says the road of philosophy is that of all other sciences—"One must first collect the facts, and then learn to know the things on which the facts originate; not the mass of facts all at once, but every one must be viewed singly and separately, and the inferences drawn from it; as soon as we have the facts it becomes our business to settle their combination.

"These facts are acquired by observations of the senses; if these latter are imperfect, the knowledge depending upon them will be so likewise."

"We cannot have any general theoretical propositions unless by induction, and induction can be made only by perceptions of our senses, for these have to deal with the individual."

These are the chief principles of investigation bequeathed to us by the great philosopher of antiquity, and they have still the same import which they had two thousand years ago.

On studying his explanations of natural phenomena and those of the whole successive series of natural philosophers, down to our own time, we find that at all times

the opinion obtained, that the conceptions were in harmony with the facts, and indeed the definitions always corresponded with the logical laws, but the later are always in opposition to the earlier; what had been held to be right is found to be wrong at a later period, and thus the subsequent definitions annul the former ones, and this goes on for centuries, hence it becomes evident that the truth of the definitions does not depend upon the principles of logic alone.

But if we consider, on the other hand the derived ideas of Aristotle and subsequent investigators, we find at once the reason why the most highly developed intellect and the keenest logic of themselves, do not suffice for a correct explanation, because this depends entirely upon the extent of the derived ideas.

At the beginning the facts which an idea includes are undefined, and their number and extent is unknown; hence it follows, *eo ipso*, that the first explanations cannot be defined or exhaustive, and that they must change in the same proportion as the facts become better ascertained, and the unknown facts, being part of the ideas, are discovered and are embodied in the idea; the earlier definitions therefore are only comparatively wrong, and the latter are more correct merely because the extent of the idea of things has become larger, clearer, and more definite. This development takes place in a certain succession.

No subsequently developed idea can precede in order of time an earlier one, and if it is ineffective, this happens because it is wanting in extent. With the earlier idea the development of all subsequent ones is bound up.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 7.

WARREN DE LA RUE, Ph.D., F.R.S., President, in the Chair.

At this, the first meeting after the summer recess, there was an unusually large attendance of Fellows, and a full programme of interesting matter was provided. The proceedings were opened as usual by reading the minutes of the last meeting, and announcing the contributions to the Society's library. Mr. Henry Dircks, C.E., was formally admitted a Fellow of the Society, and the name of Charles Meymott Tidy, M.B., of the Hollies, Cambridge Heath, Hackney, was read for the second time. The names of the following candidates were proposed for election:—Thomas Hall, B.A., Lond., Lecturer on Chemistry and Natural Philosophy at the City of London School; Charles Walter Maybury, Teacher of Chemistry, 90, King Street, Manchester; George Lunge, Ph.D. (Breslau), 10, Albert Terrace, South Shields; Facundo J. R. Carulla, Chemist to the Atlas Steel and Iron Works, 59, Gell Street, Sheffield; and Alexander Crum Brown, M.D., Lecturer on Chemistry, 4, Rillbank Terrace, Edinburgh.

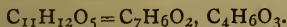
The President stated that the Council had appointed a sub-committee to consider and report upon the mode of election of Fellows into the Society, and to canvas the opinion of the members as to the qualifications necessary for the attainment of the honorary distinction which the Society has it in its power to confer. A great number of

replies had been received in answer to the circular which the Secretary issued in June last, and the committee would at an early date be prepared to advise the general body of members of the results of their enquiry.

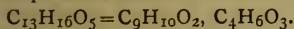
The PRESIDENT further stated that a melancholy event had occurred since the last meeting in the death of Professor Faraday. Several of the Fellows shared his own feelings in this matter, and considered that the sad occasion demanded a special notice on the part of the Society, of which the deceased was one of the earliest and most distinguished members. It was now proposed to present an address of condolence to the widow, framed in the following terms:—

“Resolution—That the Fellows of the Chemical Society request their President to convey to Mrs. Faraday their deep sense of the loss which science has sustained in the death of her highly distinguished and much esteemed husband, and that they beg respectfully to express their heartfelt sympathy with her in this great loss.”

Mr. W. H. PERKIN was then invited to read a paper “On the Action of Acetic Anhydride upon the Hydrides of Salicyl, Ethyl Salicyl, &c.” The author endeavoured to obtain the hydride of aceto-salicyl by acting upon the hydride of salicyl with acetic anhydride, but the expected reaction did not take place. There resulted from the direct union of these bodies a white crystalline substance, fusible at 103°—104°C., and insoluble in water. An analysis of this compound led to the formula—



By a similar action between the same anhydride and the hydride of ethyl salicyl a body crystallising in small brilliant, transparent prisms was formed, which fused at about 89°C. Its composition was—



The methyl salicyl compound was easily formed. Its fusion point was 75°C.

The author has likewise investigated the corresponding compounds in the benzoyl series, and arrived at results in general accordance with the previous statements of MM. Geuther, Hübner, and others; but the author does not accede to the view expressed by the latter, which asserts that the body produced by the action of acetic anhydride upon the hydride of benzoyl is identical with the diacetate of benzoyl of M. Neubauer. On the other hand, this class of compounds, like those of the preceding series, are but further examples of the same kind as the compound of acetic anhydride and ordinary aldehyde discovered by Geuther; and not identical, but only isomeric with the acetate of ethylene of Wurtz.

After a few words of explanation had been given in reply to Dr. Odling's inquiry as to what was intended by an expression made use of in the concluding paragraph of the author's paper, to the effect that “the phenolic properties disappear,” the President invited Mr. Chapman to give an account of the “Nitrous and Nitric Ethers,” samples of which were upon the table.

The authors, Messrs. Chapman and Smith, commence with a detailed account of the methods adopted by them in the preparation of the nitrites and nitrates of amyl ethyl, and methyl, and in the second place describe a considerable number of reactions and decompositions

which the ethers in question undergo on treatment with metals, acids, and sundry chemical reagents in a digestion apparatus. The most remarkable feature of the authors' communication appeared to consist in an easy mode of preparing the nitrate of amyl in large quantities. This was shortly as follows:—Nitric acid of specific gravity 1·36 was mixed with twice its bulk of oil of vitriol, and allowed to cool; of this mixture 150 c.c. was placed in a beaker surrounded by iced water, to which is added a little salt to reduce the temperature one or two degrees below zero. 50 c.c. of amyl alcohol were now gradually added from a small dropping funnel the limb of which reached nearly to the bottom of the mixed acids, and kept constantly stirred by the motion of the funnel itself, six or eight minutes being occupied in this process of admixture. No apparent action takes place beyond the production of an oily layer upon the surface of the mixed acids, which is removed by means of a separating funnel and washed in three or four changes of water. 100 parts of amyl alcohol yield by this process within five per cent of the theoretical quantity, or about 144 parts of the nitrate of amyle instead of 151. After rectification over chloride of calcium a colourless liquid is procured, which boils at 147°—148°C., and at the temperature of 7° or 8°C. has the same gravity as water. Hence there is an advantage in using warm water for the purification of the crude acid product. The inhalation of the vapour of this substance is to be guarded against, for it invariably produces headache and other distressing symptoms. The general result of the author's investigation is to show the great stability of the nitric ethers and the extraordinary chemical mobility of the nitrous ethers; bodies of the latter class are not, however, to be considered as unstable, since they exhibit no tendency to spontaneous decomposition.

The PRESIDENT, in moving a vote of thanks to the authors, referred to the interest attaching to the ready means of preparation which had been described. There was another light in which these investigations would prove valuable; namely, by pointing out facilities for obtaining some of the secondary products by simple reactions.

Mr. ROBERT WARINGTON, jun., then gave an abstract of an exhaustive agricultural research undertaken for the purpose of determining “the Part taken by Oxide of Iron and Alumina in the Absorptive Action of Soils.” Experimenting with the artificially prepared hydrates of alumina and ferric oxide, as well as with two samples of native soil containing widely different amounts of the same ingredient (or rather, “oxide of iron and alumina” 6·82 and 19·31 per cent respectively), the author tried the effects of passing solutions of tricalcic phosphate, alkaline carbonates and sulphates, ammonium salts, &c., through them for the purpose of ascertaining the rate and extent of absorption. Inasmuch as the calcareous constituents in the natural soils would have interfered with the actions which it was now intended to observe, these matters were first removed by digesting in weak acetic acid and thoroughly washing with water. The soil thus purified was left for several days in contact with a carbonic aqueous solution of the tricalcic phosphate, a current of carbonic acid gas being occasionally passed, and after the lapse of a week the ferruginous soil was found to have withdrawn 93·8 per cent of the phosphoric acid originally present in the solution and only 49 per cent of the lime, hence the author believes that the ferric oxide and alumina may be considered to possess a special affinity for this mineral acid, and that all the phosphoric acid applied to land in the shape of manure must ultimately become converted into the phosphates of these bases. If the amount of iron be sufficiently large, all the phosphoric acid will be retained by preference in the form of ferric phosphate. The absorption power of soils for potassium salts was found to be much greater in the instances of the phosphate, sulphate, and carbonate, than with either the chloride or nitrate. The corresponding ammonium salts

behaved in a similar manner. The author deduces from his experiments a general conclusion to the effect that the absorptive action of soils, for the constituents named, is dependent upon true chemical affinities, in contradistinction to the view which asserts it to be a consequence of the exercise of merely physical attractions.

In passing a vote of thanks to Mr. Warington, the PRESIDENT invited the opinions of the eminent agricultural authorities whom he saw in the room; for his own part he should incline to the belief that caustic lime, so largely applied by the farmer, would have a great influence in absorbing the phosphoric acid.

Professor WAY conceived there was more difficulty in accurately ascertaining the degree of absorption of the carbonates of ammonia and potash than in the cases of the other alkaline salts named. Mr. Warington concluded that the oxide of iron and alumina absorbed more of these ingredients than did any other constituent naturally occurring in soils, but he would remark that the very existence of hydrate of alumina was at the outset a matter open to question. This earth was generally supposed to occur in the form of a double silicate, and many kinds of clay contained lime locked up in such a manner that it could not be extracted by acids; bodies of this class had the power of absorbing ammonia without any apparent change of a chemical character.

Dr. VÖLCKER said his experimental results were mainly in accordance with the conclusions stated by Mr. Warington. He likewise had noticed the powerful absorption of phosphoric acid, and, in a less degree, potash and ammonia by ferruginous soils. There was a kind of ferric oxide precipitated by lime, which behaved in an extraordinary manner as to the amount of phosphoric acid it could take up, and lime in a soil has great influence in absorbing ammonia. So also has hydrated silica, although the artificial preparation is in this respect much inferior to the silicates naturally occurring in soils; and, again, there were other additional constituents of which no account had been taken. There was a remarkable tendency in nature for "the soil to take care of itself," and if there should happen to be a deficiency of any one ingredient this was quickly remedied by prior selection from out of a mixture of materials presented in the form of manure; thus the affinities were regulated by bulk, and the land seemed to avail itself of those constituents of which it stood most in need, and the double silicates were in this respect pre-eminently fitted to absorb ammonia, &c., as was first pointed out by Professor Way.

Dr. GILBERT said that many years ago Mr. Ronalds and himself pursued a somewhat similar line of research, and although he was not prepared to endorse all that Mr. Warington had advanced, his paper possessed merit inasmuch as it established certain points; but there was a question as to the applicability of these results to soils as they really exist. The speaker agreed with Dr. Volcker in believing that soils have almost an instinct to guide them as to what they should or ought to do.

Mr. WARINGTON briefly replied by asserting that when the soil contains lime in addition to the ferric oxide these bases act more freely but in the same direction. With regard to the absorption of phosphoric acid by a ferruginous soil it was only a matter of time as to how large a proportion was combined; humus appeared to be capable of absorbing free ammonia, and so it must be admitted that each constituent will require to be studied singly.

"Analysis of the Water of the Holy Well, a Medicinal Spring at Humphrey Head, North Lancashire," by Thomas E. Thorpe, Dalton Scholar in the Laboratory of Owen's College, Manchester. This paper was read by the Secretary, and described the composition of a brackish water issuing from the rocks on the northern shore of Morecombe Bay. Its specific gravity is 1005.8, and constant temperature 11.5° C. The results are stated both in grammes per litre and grains per gallon, the latter column only is here quoted.

	Grs. per Gallon.
Barium sulphate	0.0329
Strontium sulphate	0.2912
Calcium sulphate	88.4898
Potassium sulphate	9.1749
Sodium sulphate	24.3971
Magnesium bromide	0.0294
Magnesium iodide	traces
Lithium chloride	0.1414
Sodium chloride	331.7524
Ammonium chloride	0.0231
Magnesium chloride	43.4882
Calcium phosphate	0.0266
Calcium fluoride	traces
Calcium carbonate	9.2029
Ferrous carbonate	.2191
Manganous carbonate	0.0168
Silicic acid	1.2341
Organic matter	traces
	508.5199

A paper entitled "*On the Action of Permanganate of Potash on Urea, Ammonia, and Acetamide in strongly Alkaline Solutions*," by Messrs. J. A. Wanklyn and Arthur Gamgee, was read in abstract by the first-named author. Referring to the anomalous reactions observed on boiling various organic substances with permanganate of potash and excess of alkali, by Chapman and Smith, the authors treated the bodies named in the heading with the same reagents under a variety of circumstances. Amongst others, the following experiments were made—

	I.	II.
Urea artificial	1 gm.	1 gm.
Permanganate of potash	1.0 "	2.0 "
Caustic potash	10.0 "	10.0 "
Water	10.0 "	12.0 "

I. Heated in sealed tube for 12 hours at 130° C.
II. Heated for one hour at 160° C.

Results.—In the first experiment rather less than half the nitrogen of the urea appeared as nitrogen gas; about half was oxidised to nitrites or nitrates, and a small portion was found as ammonia. By increasing the permanganate, as in II., there was little or no oxidation; nearly all the nitrogen being liberated in the form of gas. When much weaker solutions were employed, and the materials introduced into a common retort and distilled, there was a slow evolution of ammonia, but the total quantity of nitrogen eliminated in this form, and estimated by Nessler's test, did not amount to one-fourth of that existing in the urea.

Ammonia, similarly treated with liberal amounts of potash and permanganate in pressure tubes, was completely changed into nitrate. The same result, or a nitrate, was observed in operating upon acetamide.

From a consideration of the differences in the behaviour of urea and ammonia, &c., under the action of the permanganate, the authors refuse to accept the common view that urea is carbamide; they prefer to write its formula on the marsh-gas type, thus—



Professor WANKLYN also read a paper entitled "*Verification of Wanklyn, Chapman, and Smith's Water Analysis on a Series of Artificial Waters*." The author deemed it desirable to place on record the results of a series of synthetic experiments undertaken for the purpose of testing the accuracy of the method of analysis lately proposed. Fresh albumen (white of egg) was dissolved in water with the aid of a little carbonate of soda, and diluted to make a solution containing one per cent. Various measures of this solution were diluted to half-a-litre with pure water, and submitted to distillation, first with the simple addition of .5 gm. of carbonate of soda, when it was found that

mere traces only of ammonia passed over in the first 100 c.c. of the distillate. At this stage, caustic potash (about 10 grms.) and permanganate of potash (.5 gm.) were added, and the distillation proceeded with. The total amounts of ammonia thus procured, and estimated by Nessler's test, accorded with the quantities of albumen taken, or at least within the limits of 5 per cent error. The proportion of ammonia obtained is never the total quantity, but always that corresponding to two-thirds of the nitrogen contained in the albumen; and the authors base their calculations on the fact that 1 part of moist white of egg yields .0121 of ammonia. Seven experiments of this kind were quoted by the author, performed upon quantities of albumen varying between 7 and 41 milligrammes. The estimation of urea by the same method was not nearly so accurate, and when pure materials were employed, no ammonia, or a mere trace only, was evolved; but when the urea occurs along with "albuminoid matter" in a natural water, the surrounding impurities start the action, and enable the operator to obtain much of the ammonia (.37 out of .46) by long boiling with carbonate of soda. The addition of alkaline permanganate to a known quantity of urea did not induce the evolution of the whole of the nitrogen in the form of ammonia. (See also experiment recorded in the previous communication).

At a late hour a vote of thanks was passed to the authors of the several communications, and the titles of papers in hand were announced. "*On the Pyro-phosphoric Amides*," by Dr. J. H. Gladstone; and "*The Relation between the results of Water Analysis and the Sanatory Value of the Water*," by Mr. E. T. Chapman. The meeting was then adjourned until Thursday, 21st instant.

PHARMACEUTICAL SOCIETY OF GREAT BRITAIN.

Wednesday Evening, November 6, 1867.

G. W. SANDFORD, Esq., President, in the Chair.

The minutes of the preceding meeting were read and confirmed.

Several donations to the library and museum were announced, and the thanks of the meeting given to the respective donors.

Dr. ATTFIELD made some remarks on a specimen of farina which had been forwarded by Mr. Palmer.

Mr. TILDEN then proceeded to describe a new way of preserving the syrup of iodide of iron. He began by referring to the mode of preparing it, and also to the addition of iron wire, which had not been found to prevent the change it undergoes, after the syrup has been prepared. Diffused light accelerated the action of atmospheric oxygen; but if exposed to direct sunlight it became bleached again. Mr. Tilden had found that it could be preserved from contact with the air by a stratum of oil floating on the surface; but it was necessary to put the oil into the bottle before the syrup, and it was better if kept in a dark place. The syrup might be removed from the bottle by means of a tap.

Dr. REDWOOD said he believed the introduction of iron wire was originated by Mr. Squire, but it had not been found a satisfactory mode for the preservation of the syrup, for part of the iodine was taken out of the solution through the action the iron exerted. He thought Mr. Tilden's process an ingenious one. When it was first described to him there seemed to be some practical difficulties which Mr. Tilden had taken cognizance of, and had remedied to a great extent.

Dr. ATTFIELD asked Mr. Tilden if the specimens of the syrup had exhibited any acidity. Some years ago Mr. Phillips considered that hydriodic acid was formed through decomposition of water.

Mr. TILDEN had not noticed such to be the case.

Dr. REDWOOD said if it was kept for some time the sugar would undergo a change and become solidified, being converted from cane into grape sugar, and it was quite possible that a little hydriodic acid might occur.

Mr. HILLS and Mr. UMNEY said that by bottling it all off while hot they had found it keep well for six months.

A MEMBER had noticed that by simply immersing the bottle in a water-bath for five minutes the syrup returned to its original colour.

Mr. BARNES had noticed a change in the syrup of phosphate of iron, and enquired if it was necessary to keep it in a dark place.

Dr. ATTFIELD said it was owing to oxidation, and recommended the bottle to be kept well stopped.

Dr. REDWOOD then read a paper on "*The Adulteration of White Precipitate*," which had been sent by Mr. Borland of Kilmarnock.

The author commenced by alluding to the excellent paper read at the British Pharmaceutical Conference by Mr. Barnes, F.C.S., regretting that he had not stated whether the samples he had examined were fusible or infusible. He then referred to the forms for preparing it in the Pharmacopœias. The infusible would volatilise without fusing at a heat below redness. The form for the fusible was NH_3HgCl , and the infusible $\text{NH}_2\text{Hg}_2\text{Cl}$. He had examined 24 samples, and only five were made according to the authorised form. The fusible would not make so white an ointment as the infusible.

Mr. BARNES said that three or four of the samples he examined were fusible and the rest were infusible.

The PRESIDENT was very glad to find that it was not adulterated to such an extent as it used to be.

A MEMBER asked Professor Redwood if there was any difference in the value of the two preparations.

Dr. REDWOOD was not aware that any experiments had been made.

Dr. ATTFIELD did not imagine there would be any difference in their value, the mercury being in the same condition in both preparations.

Dr. REDWOOD exhibited some moulds which had been sent by Mr. Procter to illustrate his paper "*On Suppositories and Medicated Pessaries*," in the present number of the *Pharmaceutical Journal*, in which he recommended the use of cones made of tinfoil, the usual conical shape being obtained by softening the end of a rod of gutta-percha, or of a stick of sealing-wax, and pressing it into a conical minim measure.

Several members and associates gave the results of their experience in the preparation of suppositories &c., and Dr. Attfield referred to the great merits and the great educational value of Mr. Procter's paper, showing as it did what a large amount of work could be done with simple materials, but he did not think the pessaries made in the way Mr. Procter had described were so neat in appearance as those made in the gun-metal would.

Mr. H. S. WADDINGTON read an highly interesting paper, "*On the Preparation of Microscopic Crystals*," in which he strongly recommended the process of rapid crystallisation. Mr. Waddington has evidently devoted a great deal of time and trouble in preparing processes for the preparation of microscopic crystals, and we regret that he read his paper so quickly, for it contained much that was most interesting and instructive to the microscopist. After the reading of the paper, Dr. Attfield, Professor Redwood, Professor Bentley, and the President spoke in very high terms of Mr. Waddington's paper, and hoped that he would pursue the subject still further.

Mr. UMNEY postponed the reading of a paper, "*On a New kind of Kamala*" till the next meeting, which was announced to take place on the 4th of December.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, NOV. 12, 1867.

Improvements in Automatic Telegraphy.

SINCE the 11th September, 1867, the Directors of the telegraphic lines have made use, in the service between Paris and Lyons, of a new system of rapid transmission invented by MM. Chaudassaignes and Lambrigt, telegraph clerks. This telegraph acts automatically, transmitting the despatches between the two towns at the rate of 120 or 180 despatches per hour by a single conducting wire, a velocity three times as great as that obtained by other systems, and capable of being augmented proportionately to the diameter of the wire.

The transmissions are made by a band of metallic paper on which the signals composing the despatch are traced in insulating ink. The reproduction is obtained on a band of unsized paper, the centre portion of which is impregnated with a chemical liquor necessary for the formation of the characters existing on the metallic band.

In order to obtain regularity of execution in the different operations, such as the composition, transmission, and reception, they pass through several hands according to the requirements.

One instrument in communication with the line is composed of—1. A clock-work movement. 2. A double roller which sets at work either the metallic or the chemically prepared paper. 3. A ringing apparatus for calling the attention of the correspondent. 4. A "Morse" manipulator of ordinary construction for the exchange of the conventional signs necessary for setting in movement or stopping the rollers.

The clock-work movement is set at work by a weight easily wound up by means of a pedal; it serves to maintain the rollers in movement. Near the roller round which the metallic band passes, is a point which represents the extremity of a conducting wire. The roller communicates with the electric pile. When the band is drawn into movement by the rotation of the roller, the point is placed sometimes on one of the metallic parts of the band, and sometimes on the written parts of the despatch where the isolating ink is, so that the conducting wire marks the message by the alternate passage, and breaking of the current. Near the roller, on which is coiled the unsized paper, is placed a cup filled with a solution of nitrate of ammonia and ferrocyanide of potassium. In the middle of this cup is a small roller which dips into the liquid in its lower portion, and the upper portion of which rises a little higher than the edges of the basin and supports the band of unsized paper which, drawn by the rotation of the two rollers, turns the small dipping roller and becomes impregnated with the solution.

A point of iron representing, like that of the metallic band, the extremity of the conducting wire, leans, slightly inclined, resting by its own weight upon the damp paper band, and is in communication with the earth. The voltaic current decomposes the wet portion, and leaves a coloured deposit which represents the signals of the despatch.

The working of this apparatus is entirely mechanical. The transmission and the reception of the despatches take place automatically; one clerk superintends the machine. In order to compose the despatches into conventional signals on the metallic band, another instrument, called the compositor, is employed, similar to that of Morse, the signals of which are employed. The band of metallic paper unrolling itself is raised by a lever so as to touch a thick roller covered with a resinous preparation in fusion, which cools suddenly as soon as it is applied to the metallic band. One clerk can prepare alone 35 to 40 despatches per hour; the telegraphic staff acquainted with the Morse apparatus can, without any study, compose despatches. For the service between Paris and Lyons three

compositors suffice completely for the transmissions. The despatches reproduced on a band of chemically prepared paper are handed over to other clerks, who translate them for the printed despatches distributed to the public.

The result is that two composing clerks, two translating clerks, and a superintendent of the machines of reception and transmission, do as much work by aid of a single conducting wire as six clerks with three wires by the ordinary telegraphic system. A composing apparatus furnished with electro-magnets has been established on a line from London to Paris. When the *employé* in London wishes to transmit a telegram to Paris for the Lyons line, the only line in which this rapid service is installed, he manipulates as for the ordinary transmissions of the Morse apparatus; the letters or conventional signs are printed on a metallic band, and a few seconds afterwards are transmitted to the chemically prepared paper.

Thus we have before us a great improvement in modern telegraphy. Up to 11th September last the service of the Lyons line was carried on by aid of two or three Hughes' apparatus; each apparatus occupies two clerks and three batteries. By the new system five clerks do all the service with one line only. The new system works admirably and without a single hitch, and we can affirm that the invention of MM. Chaudassaignes and Lambrigt is destined to render great service to the telegraphic service. The economy of installation, and the saving effected in the number of clerks, the maintenance, wear and tear, &c., are marvellous.

By decree of the 16th October, M. Bertin-Mouroit was named director of the scientific studies of the Normal College, in the place of M. Pasteur. M. Balard was named inspector-general of the order of sciences in place of M. Dumas. M. Pasteur undoubtedly will become professor of chemistry at the Faculty of Sciences of Paris in place of M. Dumas. Under the name of Bertin-Mouroit the learned world will recognise M. Pierre Auguste Bertin, the skilful and zealous physician who has left so happy a *souvenir* in the Faculty of Sciences of Strasbourg.

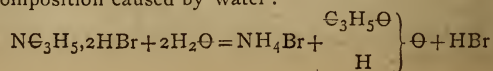
F. MOIGNO.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

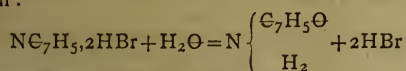
Cobaltic Sulphide.—Th. Hiortdahl. Black cobaltic oxide heated to redness in a current of sulphuretted hydrogen fuses, and is converted into a yellow sulphide of a strong metallic lustre, of the composition Co_4S_3 . Dehydrated cobaltic sulphate fused together with baric sulphide and an excess of sodic chloride, yields a mass in which after cooling prismatic crystals are observed. Sometimes the baric oxide, formed during the reaction, separates in large leafy crystals which are intersected with prisms of the sulphide. This cobaltic sulphide is of a grey colour, and shows metallic lustre; it is soluble in acids, even acetic acid, and its composition is CoS .—(*Comptes R.* lxx. 75.)

Volcanic Gases.—Janssen has investigated the flames of the volcano of Santorin by means of the spectroscopic, and found in it sodium, hydrogen, copper, chlorine, and carbon.—(*Comptes R.* lxiv. 1303.)

Nitriles, Action of Bromhydric Acid on.—C. Engler. If a current of dry bromhydric acid is passed through propio-nitrile (from potassic cyanide and sulphovinate) a crystalline mass is obtained which is propionitrilic dibromhydrate $\text{NE}_3\text{H}_3\cdot 2\text{HBr}$. It fuses between 50° and 55°C ., and sublimes when heated a little above that temperature. It is pretty stable in dry air, but decomposes readily in moist air with formation of propionic acid. The following equation shows the decomposition caused by water:



The reaction between benzonitrile and bromhydric acid takes place in an analogous manner, benzonitrilic dibromhydrate, $\text{NC}_7\text{H}_5\cdot 2\text{HBr}$, being formed. This compound differs little in its properties from the one just described; it fuses at 70° . Its decomposition with water gives rise to the formation of benzamid according to the equation:



(*Zeitschr. Chem. N.F.* iii. 506.)

Carbohydrates, Action of Water at high Temperatures on.—O. Loew. Cane-sugar is decomposed when heated with water in sealed tubes to 160°C. , carbonic anhydride is formed and carbon separates, the latter amounting to nearly half the quantity of sugar taken. The contents of the tube show strong acid reaction, due to formic acid; a small quantity of ulmic acid is also formed. No decomposition takes place if sugar is heated with alcohol to the same temperature, or with a solution of baric hydrate. Other members of the sugar-group treated in this manner show a similar behaviour. The action of water on gum gives rise to the formation of a new acid which is insoluble in water but soluble in alcohol and ether.—(*Sill. Am. J.* [2] 43, 371, and *Zeitschr. ch.* iii. 510.)

Ferrocyanides, Volumetric Determination of.—Gintl. The solution containing a ferrocyanide-compound is acidulated with sulphuric acid (in preference to chlorhydric acid, which causes turpidity), a trace of a soluble ferric salt is added, and the quantity of ferrocyanide measured with a standard solution of potassic permanganate. The end of the operation is marked by the sudden change of the originally blueish-green colour of the solution into a yellow and finally red tint.

Ferrocyanides are previously converted into ferrocyanides by reducing them with sodium-amalgam.—(*Akad. Z. Wien.* lv. 1867.)

MISCELLANEOUS.

Experiments in Electrolysis.—It has generally been inferred that the power of nitro-hydrochloric acid as a solvent for gold and platinum is owing to the evolution of free chlorine. The proof of the inference has been this:—When aqua-regia is heated until no more chlorine is evolved, the residual liquid is “found to be a solution of hydrochloric and nitrous acids that is incapable of dissolving gold.”—Turner. In experimenting on the electro-lysis of compounds the other day, it occurred to me that this hypothesis is capable of decided proof; and this was the series of experiments. (1). Into an ordinary apparatus for the electro-chemical decomposition of water, having platinum electrodes, a weak solution of hydrochloric acid was poured. Over the anelectrode a glass tube was placed, and in this tube some gold leaf. Twelve pairs of Wollaston's double coppers were employed excited by dilute sulphuric acid only. On completing the circuit, the penetrating odour of chlorine was very perceptible, and in a few seconds the gold in the tube over the anelectrode was completely dissolved; as also were some fragments that had been put into the solution outside the tube. (2). If chlorine has this power over gold it may be supposed that the chloride of either a metal or an alkali, providing that the compound is an electrolyte, will exhibit, on electrolysis, the same result. Chloride of sodium was the substance first experimented with. A saturated solution of the salt was made, and with precisely the same arrangement as before, the gold in the tube over the anelectrode was speedily dissolved. (3). The same result was obtained on electrolysis a solution of chloride of ammonium and chloride of barium. By a power of 20 pairs of Wollaston's double coppers the gold was dissolved with a rapidity equal to that when a

solution of chloride of sodium was the liquid electrolysed. Both times the blue colour of litmus was quickly discharged, but there was no previous reddening of the colouring matter to indicate the generation of hydrochloric acid. (4). A solution of chlorate of potassa was the liquid next electrolysed. With the same power of 20 plates the gold was very gradually dissolved, though the battery was in good action. The odour of chlorine was perceptible, though fainter than in the former experiments. A solution of litmus was poured into the vessel, and a tinge of red was then perceived at the anode owing to the action of the evolved chloric acid upon the colouring matter. The blue colour of the solution became fainter by degrees, evidently proving that since chloric acid does not possess bleaching properties, free chlorine was evolved. Possibly this formation of chlorine from chloric acid is a secondary result of the current; but it is quite as probable, and more so, that the chlorate of potassa and the chloric acid were successively decomposed by the current of electricity. I am not aware that the dissolution of gold, and the influence of chlorine over the metal has been shown in this way before. True, Davy has proved that nitro-hydrochloric acid does not dissolve gold unless free chlorine is developed. Mr. Grove, also, has shown the action of chlorine liberated by the voltaic current; but in a different way. Two strips of gold leaf, one in nitric, the other in hydrochloric acid, in contact through a porous division, were connected by a gold wire: the hydrochloric acid was decomposed, and the gold in it immediately dissolved. The experiments now made, may not possess the less interest because they refer to a foregone conclusion, and show that by the decomposition of other compounds of chlorine besides hydrochloric acid the precious metals may be dissolved.—Ernest W. Bartlett.

The Pascal-Newton Forgeries.—Sir David Brewster has forwarded the following letter to the *Times*:—“As the French Academy of Sciences is now convinced that the Pascal and Newton Letters are forgeries, it has become an object of interest to discover the name of the forger, the time when he executed his work, and the motives by which he was influenced. That M. Pierre Desmaizeaux, a Frenchman resident in London, was the author of these forgeries, will appear from the following considerations:—1. Desmaizeaux resided in England between the years 1692 and 1745, the year of his death. He was a Fellow of the Royal Society, and was intimately acquainted with Newton and with the leading scientific men of the day. He was a contributor to the *General Dictionary*, as is stated in the preface to that work, and he possessed that knowledge of physical science which appears in the correspondence between Pascal and Newton. 2. Desmaizeaux's work entitled *Recueil de Diverses Pièces, &c., par Leibnitz, Clark, et Newton*, several portions of which appear in the forged letters of Newton, connect him in a peculiar manner with the forgery. 3. Desmaizeaux is the most important personage in the fabricated documents—the hero in the romance so ingeniously composed to transfer the discoveries of Newton to his countryman. He is himself the author of six of the letters published by M. Chasles, and no fewer than nine are addressed to himself by some of the most distinguished writers of the day. 4. Desmaizeaux's poverty adds to the evidence of his being the forger. He lived chiefly by his writings. He was employed by Dutch booksellers to send them literary news from England. In a letter to a nobleman, in 1732, he states ‘that he was reduced to a pension on the Irish Establishment, which brought him in £40 a year.’ . . . ‘After 40 years stay in England, and in an advanced age, I find myself and family destitute of a sufficient livelihood, and suffering from complaints in the head and impaired sight by constant application to my studies.’ 5. Desmaizeaux's character, both in its religious and moral aspect, was quite consistent with his criminality as a forger and a systematic slanderer of Newton. ‘He was a great

man,' says Mr. Disraeli, 'with those who are pleased to be called Free-thinkers, particularly with Mr. Anthony Collins, and collects passages out of books for their writings.' Anthony Collins, who was a great friend of Locke, placed such confidence in Desmaizeaux that he bequeathed to him eight octavo volumes of his manuscripts, 'in order,' as Disraeli says, 'that they might be secured from the common fate of manuscripts.' In an unguarded moment, however, he relinquished this precious legacy of the manuscripts, and accepted 50 guineas as a 'present' from Mrs. Collins, who, it is supposed, threw them into the fire. 6. A large portion of the forged correspondence, embracing 120 letters from Newton, and 88 letters and notes of Leibnitz, was in Desmaizeaux's house at the time of his death in 1745, and either he himself or his family sold it for £800 to a celebrated collector of manuscripts. During the interval between 1734 and 1740 he had no doubt good employment as a contributor to the *General Dictionary*, and it is therefore probable that he spent the last five years of his life in the difficult work of composing the Pascal and Newton Correspondence. That his motive was to calumniate Newton, who was his friend, and exalt Pascal, who was his countryman, is by no means probable. In 1743, two years before his death, he had, as Disraeli tells us, 'procured his pension to be placed on his wife,' and there can be little doubt that his crime against Newton, like his crime against Collins, had no other object than to make a provision for his family."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2657. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in the manufacture of iron."—Petition recorded September 21, 1867.

2952. W. Crossley and T. C. Hutchinson, Middlesbrough-on-Tees, "Improvements in the manufacture of alumina and salts of alumina from blast furnace slag, or from other silicates of alumina containing an excess of lime or magnesia."—October 21, 1867.

2976. S. Welton, Grafton Street, Fitzroy Square, Middlesex, "Ozonised or oxygenated bread, biscuits, cakes, and other substances."—October 23, 1867.

2984. F. Gerharz, Cologne, Rhenish Prussia, "Improvements in the manufacture of manures and disinfectants."

2998. R. Wear, Compton, Staffordshire, "Improvements in and in apparatus for the treatment and for the reception of urine and fecal matter."—October 24, 1867.

3006. W. R. Lake, Sonthampton Buildings, Chancery Lane, "Improved modes of and means for curing, drying, preserving, and packing meat, fruit, vegetables, and other perishable substances."—A communication from D. E. Somes, Washington, U.S.A.—October 25, 1867.

3032. J. Young, Aspull, Lancashire, "Improvements in the application of Cannel coal 'slack' to the manufacture of gas and coke."—October 28, 1867.

NOTICES TO PROCEED.

1845. J. Webster, Birmingham, "A new metallic zinc paint."

1850. L. Brunetti, Rovigno (Italy), "An improved process of embalming and preserving animal substances from decay for anatomical purposes."—Petitions recorded June 25, 1867.

1900. A. M. Fell, West Calder, Mid Lothian, N.B., "Improvements in purifying or preservative compounds to be applied to the fleeces or skins of sheep and other animals."—June 29, 1867.

2034. J. H. Johnson, Lincoln's Inn Fields, Middlesex, "Improvements in the manufacture of refined sugar."—A communication from E. P. Eastwick, Baltimore, Ma., U.S.A.—July 11, 1867.

2484. C. Gelstharpe, Low Walker, Newcastle-on-Tyne, "Improvements in the manufacture of malleable iron, cast iron, and steel, and in the construction of furnaces to be employed for such purposes."—September 2, 1867.

MEETINGS FOR THE WEEK.

Thursday, November 21.

CHEMICAL SOCIETY.—"On Pyrophosphoric Amides," by Dr. Gladstone. "Connection between results of Analysis and Sanitary Condition of Water," by Mr. Chapman.

Friday, November 22.

QUEKETT MICROSCOPICAL CLUB, University College, Gower Street,—"The Wools of Commerce," by Mr. N. Burgess.

CONTEMPORARY SCIENTIFIC PRESS.

[Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the CHEMICAL NEWS.]

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien. (Mathematisch-naturwissenschaftliche Classe.)
March, 1867.

H. HLASIWETZ, "On Hydrocafeic and Hydroparacoumaric Acids." A. ROLLETT, "On the Effect of Contrast on Colours." J. SEEGEN, "On the Separation of Nitrogen from Albuminoid Substances in a Dog." V. VON LANG, "On the Optical Properties of Crystallised Compounds of Ammoniacal Bases, and of Salts of Thallium, Rubidium, and Cæsium, with respect to Homologous and Isomorphous Series." A. ROLLETT, "On the Theory of Accidental Colours, and of the Change in the Colour of Accidental Images."

April.

M. EROFEJEFF, "On the Determination of the Principal Index of Refraction of Sulphate of Ammonia." V. VON LANG, "An Improved Apparatus for Measuring the Optic Axes of Crystals." W. VON HADINGER, "On J. Schmidt's Observations on Meteoric Stones, and on the Ridges of the Surface of the Moon." O. REMBOLD, "On Quinotannic Acid." O. REMBOLD, "On Quinova-tannic Acid." A. GRABOWSKI, "On Rhatania-tannic Acid." G. MALIN, "On Fillico-tannic Acid." A. GRABOWSKI, "On Fillico Acid." O. REMBOLD, "On the Tannic Acid of the Root Bark of the Pomegranate Tree." H. HLASIWETZ, "On the Relations between the Tannic Acids, Glucosides, Phlobaphenes, and Resins." E. BRUCKE, "On the Action of Boracic Acid on Living Muscular Fibre." E. KLEIN and E. VERNON, "On the Importance of Salt as an Article of Human Food."

Sitzungsberichte der Königlich-Bayerischen Akademie der Wissenschaften zu München. (Mathematisch-physikalische Classe.)

February 9, 1867.

M. VON PETTENKOPFER and VOIT, "On the Carbonic Acid exhaled and Oxygen consumed by Man." VON KOBELL, "On the Behaviour of Disthene in the Stauroscope, and on the Permanence of the Cross observed under such Circumstances." A. VOGEL, "On the Estimation of Fat and Albumen by a Method based on the Principle of the Optical Milk Test."

Jahrbuch der Kaiserlich-Königlichen Geologischen Reichsanstalt.
January-February, 1867.

V. VON ZEPHAROVICH, "On Fluorite from Hiefau, Styria." F. RAUEN, "Note on the Present condition of the Ore-washing Establishments of Schmeitz." K. VON HAUER, "Analysis of Brown Coal, Lignite, Copper, Slag, and Iron Ores."

NOTES AND QUERIES.

Palm Oil.—Where can I find instructions for isolating the colouring matter of palm-oil; or how it can be effected?—S.

Perfect Vacuum.—"Electron" will find a paper by Dr. Andrews on a method of obtaining a perfect vacuum, in the Philosophical Magazine, series 4, vol. iii., p. 104. I believe Mr. Cetti now makes vacuum tubes so perfect that they will not allow an induction current to pass. I believe the process for making these has also been published, but I cannot say where.—W. THOMPSON.

Chloride of Barium.—Your Paris Correspondent, in a recent number of your valuable journal, states that Messrs. Burgoyne and Co. manufacture chloride of barium in a pure state, and that they are selling the same at £30 per ton. To my thinking £30 is a very high price to ask for this article; I wish therefore to state that I have made large quantities of chloride of barium, nearly absolutely pure, disposing of the same (of course at a profit) at £9 per ton.—J. H. SWINDELLS.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the CHEMICAL NEWS will shortly be removed from Wine Office Court, Fleet Street, to
BOY COURT, LUDGATE HILL, E.C.

R. Medwin Hands.—Consult the Free Library of the Patent Office Southampton Buildings, Chancery Lane.

W. B. G.—Wöhler's researches on the nitride of boron may be found in the *Chemical Gazette*, vol. vii. p. 234. We shall be glad to hear particulars of your experiments.

Student.—There is no cheaper process for procuring chlorine on a large scale than the reaction of sulphuric acid and salt, or of hydrochloric acid, on binoxide of manganese. This is the process universally adopted in chemical works.

T.W.—Asks how to precipitate double chloride of platinum and aluminium from a solution of the two metals in *aqua regia*. No such compound is known. It might possibly be obtained by careful evaporation of the acid solution referred to, but it could not be precipitated.

THE CHEMICAL NEWS.

VOL. XVI., No. 416.

ON THE SEPARATION OF CERIUM FROM DIDYMIUM AND LANTHANUM.

By M. M. PATTISON, Andersonian, Glasgow; and
JOHN CLARKE, Ph.D.

THE following method has been found to be very effective for the separation of cerium from didymium and lanthanum:—

It is based upon the fact that when chromate of cerium is evaporated to dryness and heated to about 230° F., it is decomposed, and the oxide of cerium remains as an insoluble powder, whilst the chromates of didymium and lanthanum, when subjected to the same treatment, remain unchanged.

The mixed oxides of cerium, didymium, and lanthanum are subjected to the action of an aqueous solution of chromic acid, aided by heat till solution is complete. The chromic acid need not be entirely free from sulphuric acid. The solution obtained is evaporated to dryness, and the residue heated to about 230° F. Hot water is then added, which dissolves the lanthanum and didymium and leaves the oxide of cerium, which is then separated by filtering. Thus obtained, the oxide of cerium is a yellowish-white powder which is almost completely insoluble in acids, but is rendered soluble when fused with the acid sulphate of potassium.

This process may also be employed for the quantitative determination of cerium, as it was found by careful trial that not a trace of cerium could be detected by the best known processes in the solution, after its separation, as above described.

ON THE COMPOSITION AND METALLURGY

OF SOME NORWEGIAN IRON ORES.

By DAVID FORBES, F.R.S., &c.

THE iron ores here under consideration were all strongly attracted by the magnet, and, with the exception of traces of iron pyrites and pyrrhotine, all the iron contained in them was found to be present in the state of magnetic oxide (Magnetite).

The percentage of metallic iron, besides being calculated from the amount of sesquioxide of iron obtained in the course of the analysis, was also determined in a separate portion of the ore by the bichromate of potash volumetric process, after its previous solution and reduction to the state of protoxide by metallic zinc; the oxygen combined with the iron was estimated from the loss in analysis.

The portion of the mineral employed for determining the amount of sulphur was dissolved in nitrohydrochloric acid, filtered from the insoluble siliceous matter, and the filtrate evaporated nearly to dryness in a water bath, so as to expel the excess of free acid (which otherwise might augment the solubility of the sulphate of barytes), and after having been precipitated by chloride of barium, the sulphate of barytes was estimated as usual.

Phosphorus was sought for in a larger amount of the ore, both by Abel's and Spiller's processes (CHEM. NEWS,

vol. vi., p. 133, and vol. xiii., p. 170), and also by the molybdate process recommended by Eggertz.

The manganese was separated from the iron by carbonate of barytes, and the other constituents, carbonic acid, lime, magnesia, and alumina determined as usual.

The ores No. 1, 2, and 3 occur as veins in the limestones and calcareous shales of the Silurian formation lying to the west of the river Dram in Norway, and have long been worked for the supply of the charcoal blast furnaces in the vicinity.

These deposits of magnetite are in some places greatly disturbed by the intrusion of eruptive granite and trappean rocks; of these the granites are the oldest; breaking through the Silurian strata they frequently dislocate both these and the iron veins, and often send out dykes cutting through the masses of iron ore and dividing it into sections, or as it were, chambers, separated from one another by walls of granite of varying thickness; the quality of the iron ore does not appear, however, to have been affected or deteriorated at these points.

The trappean dykes, being of still later age, traverse alike both the Silurian strata, iron veins, and granitic intrusions, and in general are found to have a very injurious effect upon the iron ore in immediate contact with them, causing it (sometimes to the distance of several feet) to become more or less strongly impregnated with sulphur, which, combining with the iron, shows itself as pyrites and pyrrhotine, both of which minerals are usually found in greater or less quantity diffused throughout the substance of the rock of the dyke itself.

No. 1. Magnetite from the Aaserud mine, about 5 miles north west of the town of Drammen.

The specimen analysed was extremely compact in texture, strongly magnetic, and was intersected by minute veins of carbonate of lime; some traces of a greenish silicate were also visible, but otherwise the ore appeared quite free from impurity; it was broken out at a depth of 122 feet from the surface.

The specific gravity was found to be 4.56.

The chemical analysis afforded the following percentage composition:—

Iron, metallic	58.24
Oxygen (or loss)	22.20
Protoxide of manganese	0.14
Carbonate of lime	7.44
" of magnesia	2.48
Alumina	8.00
Silica	1.35
Sulphur	0.15
Phosphorus	0.00

100.00

In the metallurgical treatment of this ore, owing to its extreme compactness in texture, it requires a prolonged roasting in order to render it as porous and permeable to the reducing action as possible, since, when but lightly roasted, the ore always contains hard unaltered kernels, and is found to be much more irregular and refractory in the furnace.

The ore in lumps of the size of a fist, is roasted in (somewhat conical) cylindrical kilns fired by the waste gases from the blast furnace, brought down from a depth of about 16 feet below the top of the furnace. It remains in the roasting kiln about from twenty-four to thirty hours; the small amount of sulphur contained in the ore seems to be entirely removed during this operation.

Beyond being charged into the furnace, the roasted ore (and also the limestone used as a flux) is broken up by rolls or stamps to the average size of a hazel-nut, and the charges of ore, limestone, and charcoal are not allowed to exceed at a time about 600 pounds of the calcined ore along with from 30 to 60 lbs. limestone, and 34 cubic feet of fir and pine charcoal; the whole being carefully distributed over

the area of the furnace mouth. The blast is obtained from three double-acting horizontal boxes driven by a water-wheel and working into a regulator, from which the furnace is supplied by two tuyeres, the blast being previously heated in an apparatus at top of the furnace fired by the waste gases. The dimensions of the blast furnace are as follows:—Diameter of hearth, 2 feet 6 inches; diameter greatest, 7 feet; height from bottom of hearth to tuyeres, 1 foot 6 inches; do. from line of tuyeres to greatest diameter, 7 feet 6 inches; do. from greatest diameter to top of furnace, 37 feet; consequent total height from floor of hearth to top of furnace 45 feet.

The bottom stone of the furnace is made of Newcastle sandstone, on which the first eight feet in height of the interior is formed of English (Newcastle) firebrick; above this the entire lining of the furnace is built of slag from the furnace itself, cast in the form of large brick moulds. These slag bricks have been proved to stand excellently; in some cases even for more than four years, during which the furnace has been in continuous operation. They appear to undergo a change similar to the conversion of glass into Reaumur's porcelain. The exterior of the furnace is built entirely of the rough unhewn stone of the neighbouring hills.*

When in good trim, and smelting the ore from the above mine (which, however, only averages about 44 per cent iron on the large scale) for the production of first-class charcoal pig for conversion into Bessemer steel, the burden and yield of the above furnace is about as follows:—

Ore smelted weekly, 68 tons; limestone (Silurian) used as flux, 5 to 6 tons; charcoal consumed, 10,750 English cubic feet; yield of pig iron, 30 tons, or 44 per cent of the weight of ore.

The furnace is tapped three times per 24 hours, at 8 a.m., 4 p.m., and midnight respectively, and the cast iron run into chills weighing each about 75 pounds.

The charcoal used is made from the spruce and Scotch firs, and burnt (in heaps) in the open air; as the weight of a given volume of charcoal differs greatly according to the season of the year, the quickness of burning, the length of time it has been burnt before weighing, and the humidity of the atmosphere, it is considered better to use volume instead of weight in such calculations; since, however greatly the weight may alter under these circumstances from the absorption of moisture, the bulk remains comparatively the same.†

When white iron is obtained (instead of the dark grey black) this consumption of charcoal is much diminished, and much more ore can be run through the furnace in the same time.

The slag is glassy, and of a light yellow or brownish tinge, containing only a mere trace of iron; when in thin splinters it is both transparent and colourless.

Until the last two years the whole of this iron has been manufactured with charcoal in Lancashire hearths, into hammered bars of a quality equal to the finest Swedish brands, and as this iron has shown itself particularly adapted for conversion into steel it has been chiefly employed for that purpose from as far back as the middle of the last century.

Since the introduction of the Bessemer process the pig iron from this ore has shown itself equally adapted for conversion into Bessemer steel of admirable quality, and the whole production is now employed for this purpose; the pig exported for conversion shows a dark black grey brilliant crystalline fracture, with the lower part

chilled to the extent of half an inch or more; both parts, however, being very uniform in appearance.

No. 2. Magnetite from the Saasen mines, about four miles from the east side of the Ekeren Lake.

This ore is compact, strongly magnetic, and contains an admixture of a green silicate, probably epidote, along with a little carbonate of lime; the sulphur present in the ore is evidently in the form of pyrrhotine, as specks of this mineral are seen disseminated in the ore. Its specific gravity was 4.22. On analysis its composition proved to be as follows:—

Metallic iron	61.88
Oxygen (or loss)	20.57
Protoxide of manganese	0.51
Carbonate of lime	3.24
Alumina	2.69
Lime	1.12
Magnesia	0.29
Silica	6.50
Phosphorus	trace
Sulphur	0.25

100.00

This ore, although not quite so compact as that from the Aaserna mine, contains more sulphur, and consequently requires a prolonged roasting to get rid of this deleterious ingredient.

The roasted ore melts well, and requires about the same amount of charcoal for its reduction as the last described ore, affording a strong light grey iron slightly chilled; there was an evident tendency to the production of white iron.

The slag was nearly free from iron, of a dull yellow colour, and crystalline; it frequently showed streaks of a blue tint, which is commonly found when smelting ores containing sulphur, especially when irregularly roasted.

When converted with charcoal in the Lancashire hearth into bar, it afforded a good strong and tough bar, but in quality rather inferior to the iron from the Aaserna ore; the quality of this, however, would doubtless be much improved if more attention were paid to the sorting and roasting of the ore previously to smelting.

No. 3. Magnetite from the Narverna mine, about three miles from Drammen.

This ore was very strongly magnetic, and possessed a granular texture; it invariably contained particles of iron and copper pyrites disseminated throughout the entire substance of the vein mass; the only other mineral occurring in it appeared to be allocroite, which was frequent. The specific gravity was 4.39.

In the analysis, the copper was precipitated from the solution of the ore in hydrochloric acid by sulphuretted hydrogen, and determined subsequently as oxide; the composition of this ore was found to be:—

Iron, metallic	57.59
Oxygen (or loss)	23.22
Copper	0.79
Protoxide of manganese	0.65
Lime	2.85
Magnesia	0.14
Alumina	3.55
Silica	10.25
Phosphorus	0.00
Sulphur	0.96

100.00

On account of the amount of copper and sulphur contained in this ore, the pig-iron produced in the blast furnace was not convertible into malleable bars when treated with charcoal in the Lancashire hearth.

As the ore itself on the large scale contained an average of over 50 per cent iron, and the deposit was capable of yielding an immense supply at a nominal price, it became

* The iron works here referred to are respectively situated at Eidsfoss, on the Lake Ekeren, and at the mining town of Kongsberg. The author has been connected with the same in the capacity of consulting engineer ever since 1847, first to the Norwegian proprietors, and now to the present owners, the Norwegian Charcoal Iron Company.

† Two different managers of these works considered one English ton of charcoal as equal to 242 and 255 English cubic feet respectively. The consumption of charcoal according to the above data will consequently be about 158 cubic feet per ton iron ore smelted, or 358 cubic feet per ton pig iron produced.

of some importance to inquire whether some means might not be found to eliminate the sulphur and copper, and thus enable the ore to be utilised for malleable bars.

For this purpose several experiments were made (both on the small and on the large scale) in roasting the ore in lumps in kilns as well as in coarse powder in a reverberatory furnace heated by the waste gases of the furnace, sometimes with the assistance of a jet of steam playing upon the red hot ore during the calcination. In some instances the ores thus treated were at once reduced in the blast furnace, but in others they were spread out in the open air, and occasionally sprinkled with water in order to facilitate the oxidation and dissolve out any sulphates of iron or copper formed. After well washing out they were again roasted and melted. Although much better results were obtained by so treating the ores, the bars were never sufficiently good for the charcoal iron market, and the results of these experiments were conclusive only as showing that on the large scale, the ores could not, practically, be sufficiently purified to fit them for the production of malleable bars of good quality.

The pig iron produced from this ore, even when roasted in the ordinary manner, is well adapted for foundry use, and is employed with advantage in making the finest ornamental castings. For this purpose a small admixture of common English pig (about 20 per cent) is usually added, and is considered to render the metal softer.

In order to examine whether the ore could be smelted to advantage with coke imported from England, instead of with charcoal, a trial smelting of some weeks' duration was made with Newcastle coke in the same furnace (the dimensions of which have already been given) which was employed for smelting the ore with charcoal.

The furnace was evidently not well adapted to coke. The hearth (of stamped quartz powder) did not stand well; the blast appeared too weak for the heavier coke.

The results, however, possess considerable interest, since both smeltings were carried on under similar circumstances.

Not taking into consideration the irregularity of the actual smelting trials, the results of these experiments may be stated approximatively as follows:—

	Smelting with charcoal.	Smelting with coke.
Iron ore smelted per week	70 tons	80 tons
Cast iron produced	36 " " "	41 " " "
Charcoal consumed	44 " (10,800 cubic ft.)	" "
" per ton iron ore smelted	0.63 " " "	" " "
" " cast iron produced	1.22 " " "	" " "
Coke consumed per week	" " "	44 " " "
" per ton iron ore smelted	" " "	0.55 " " "
" per ton cast iron produced	" " "	0.88 " " "

In both cases the percentage of cast iron obtained from the ore was about the same, or an average of 51.3 per cent.

Other experiments with coke make it probable that under conditions more favourable to its employment, much more advantageous results would have been obtained.

No. 4. Magnetite from Ringkjern mine, Sandsvoerd, near Kongsberg.

The lode containing this ore was situated in granite gneiss, cutting this rock at a nearly vertical angle.

It contained small veins and fragments of white and nearly pure quartz associated with it, as well as occasionally traces of violet fluor spar, and, besides these minerals, it also had numerous specks and large blotches of iron pyrites, from which it could only be separated by careful breaking and hand picking.

The magnetite itself presented an appearance totally different to that of this mineral in general, and would be at first sight taken for iron glance or specular iron ore, since it consisted entirely of an aggregate of radial plates or scales of the mineral, of a bright black metallic lustre. It gave, however, a black to brownish black streak, and was very strongly magnetic.

The specific gravity were 4.16: the results of its chemical analysis were found to be as follows:

Metallic iron	67.73
Oxygen (or loss in analysis)	25.81
Protoxide of manganese	0.32
Lime and magnesia	traces
Alumina	0.75
Silica	5.00
Sulphur	0.39
Phosphorus	traces
	100.00

This ore, owing to its peculiar foliated texture, roasts with great ease, and also reduces well in the furnace, but always yields a white pig, which has only been employed for castings. The slag produced was clean, and of an opaque yellow colour, frequently crystalline, and always having blue streaks, apparently due to the sulphurous ore.

The amount of silica contained in this ore accumulated a much larger amount of limestone as flux than was required when smelting the three before described iron ores. Some experiments made on this pig-iron converted with charcoal in a Lancashire hearth produced hammered bars of inferior quality, being red-short. They, however, possessed no trace of cold-shortness, and were of an extremely tough fracture when broken cold, so that it is probable that a better sorting and calcination of the ores would enable the ore of this mine also to be employed in the manufacture of hammered bars for the market.

ON THE DEVELOPMENT OF IDEAS IN NATURAL PHILOSOPHY.*

By JUSTUS VON LIEBIG.

(Continued from page 252.)

The definitions of natural phenomena by the Greek and subsequent philosophers prove the extent and comprehension of their "derived ideas," and nothing more; and from this point of view they offer a peculiar interest for the history of the development of ideas in natural philosophy, inasmuch as we discover in them the first outlines in the elevation of our ideas. Aristotle distinguishes the solid from the liquid and the æriform. All solid bodies are to him varieties of *one* solid; it can be perceived that transparent bodies have something in common with water, but language does not suffice to define the other varieties of solid bodies, such as form, colour, or hardness; only what can be produced from them or what results from them are definable. One white stone yields in the fire lime, another white stone fuses to glass, one red stone produces iron, another mercury, a grey stone tin, a black one lead. "The essence of things," Aristotle says, "lies in the form." *This is the first conception of chemical analysis.*

Daily experience teaches us that solid bodies cannot float "in the air or in space without being suspended by something; and as the stars are seen behind the moon, and the moon is nearer to the earth than the sun, these celestial bodies, being solid bodies, must be fastened to transparent rings or discs which move round the earth together with the celestial bodies."

A freely falling stone moves towards the earth with increasing velocity; sense and mind are quite incapable of recognising that the earth has any part in the falling; it is evident there must be a desire within the stone to return to the place assigned to it by nature. *This is*

* A Lecture delivered at the Meeting of the Royal Academy of Science, at Munich.

the commencement of the idea of gravity, or of an attractive force.

These ideas of the Greeks were perfectly in harmony with their experience, and correct so far as they could not have any others. The idea of time, embodied in the compound idea of velocity, was developed and incorporated with the latter 1,500 years after Aristotle. Watches or measures for short intervals of time the Greeks did not possess. At the commencement of investigation of nature the compound phenomena of rain, of the rainbow, of burning and breathing, are taken simply as a matter of course, for nothing is known of their parts; at a later period it is discovered that the rain is preceded by a formation of clouds, that without sun, no rainbow is formed, and that without air, burning and breathing cannot take place. That part of the phenomenon which is observed at a later time is always looked upon as the cause, the sun as the cause of the rainbow, the air as the cause of breathing and burning, just in the same way as the course of the moon is thought to be the cause of ebb and flow of the tides.

And in this respect the tracing out and defining of the manifold relations of water by Thales, of air by Anaximenes, of fire by Heraclitus, belong to the greatest discoveries, for these philosophers thereby created the field for all questions connected with the most important occurrences on the surface of the globe, with animal and human life—questions which have occupied us up to the most recent times.

From the acute analyses of words by the Greek philosophers, we learn with great precision the sum total of the ideas included in the words which they used in their mental operations, and it might suffice to compare the contents of one of these words—of the word “air,”—to obtain a clear conception of the “derived ideas” of those times and of their development.

The Greeks knew that air inclosed in a bladder resists pressure, and that a glass inverted into water does not fill with the water. Air was looked upon as a space filling, resisting matter, as an element, and next to fire, *i.e.*, smoke ascending into the air, as the lightest element. Up to the beginning of the 16th century, air was considered to be convertible into water,—in the middle of the 16th century as not convertible into water. It was found to contain water in a gaseous form; in the year 1630 the idea obtained that it was heavy, *i.e.*, ponderable matter; in 1643, that it pressed with its entire weight upon all bodies on the surface of the globe; in 1647, that the invisible particles of air press also upon each other and are elastic, that the lower air strata are denser than the upper ones; in 1660, that different kinds of air or gases, elastic like common air, could be artificially produced by chemical processes; in 1727, that such like gases were also in plants, animal matter, ores, and metallic calxes, not as products, but as educts, some inflammable, some stifling fire. In 1774, it was found that among these gases was one in which inflammable substances burnt more briskly than in common air, in 1775, that atmospheric air consisted chiefly of a mixture of two gases, one of which supported combustion, the other not, also that it contained variable quantities of aqueous vapour; at the end of the 18th century, that it contained carbonic acid; in the 19th century, that it also contains ammonia, nitric acid, and, lastly, that all kinds of fungi were floating in the air. Our position in regard to the notion of “air” has been acquired by the labour of hundreds of the most clear-sighted men during an interval of more than 2,000 years, by constantly enlarging, separating, and limiting the first notions; and this constitutes the difference between all notions of matter and of phenomena formerly entertained and, those we have to-day. By-and-bye I shall take occasion to show that the discovery of facts which were added to the notion of air, and which gradually enlarged and defined more completely its extent, was precisely the conception of the facts, *i.e.*, that they were first “conceived” and afterwards discovered.

It will easily be observed that most of our notions in philosophy, and especially in jurisprudence, have been

traced out and developed in an exactly similar manner, and that our present ideas of the words “state” or “church” convey a different meaning to what they did 100 years ago. “The idea of divinity” changes and develops with the notion of “force.”

Every one of our present notions is the result of time and of infinite labour and mental effort, and if our speculations are less bold than those of the Greeks, it is exactly because their example has taught us that the highest flight of imagination and the most acute logic do not alter our position, and that they are without influence upon the regular course of the development of the “derived ideas.” Euclid, with his powerful mathematical mind, thought we looked out of the eyes by means of optical rays. Descartes, one of the greatest philosophers of all times, could not raise himself to the idea of an attractive force.

Very widely spread is the opinion that a gap exists between the Greek and modern philosophy up to the 15th century, and the historians designate the middle ages as the period of stand-still, and the 15th century as that of the re-awakening of science.

This view if applied to Europe is only partly correct, and it cannot hold good for the western parts of Europe, for Germany, England, and the present France. In these countries Greek and Roman culture could not be extinguished in the middle ages, simply because it found entrance into them only at a much later period. We must recollect that at the time of the Academies of Athens Western Europe was inhabited by half savage races who were clothed in hides, that under Charlemagne most of the dignitaries and the most powerful barons of the empire could not write their own names, that in the 13th century Rome was still the centre of the Christian slave trade, and that large slave markets existed at Lyons and in the coast towns of the German Ocean and of the Baltic.

The endeavours of the great Emperor to impart mental cultivation into the rude and ignorant clergy of his time, by the foundation of schools, could not be crowned with success, because the ground on which culture spreads had not been prepared by cultivation. The development of culture, *i.e.*, the enlargement of the sphere of the human mind, depends upon the increase of inventions of the populations, which modify the progress of their civilisation; for by these inventions new facts are gained from nature which are absolutely indispensable for the augmentation of the “derived ideas,” or the matter of human thought. But other conditions are yet required for the development of science, whose parent is Culture. Science depends upon the rise of a social class which devotes its energy to the cultivation of the mental domain to the exclusion of every other purpose. The men who apply themselves to this task do not produce any articles which they can realise in exchange for the necessities of life, like goods in the market, and therefore such a social class cannot spring up until a certain surplus of wealth has accumulated amongst the populations not necessarily required by its possessors to meet their material needs. Only with the introduction of such a state of things are the mental demands of any avail, and the proprietary class exchanges part of its wealth for the sake of cultivating the mind.

Although an uninterrupted traffic without obstacle to the diffusion of Byzantine learning existed in the middle ages between the Eastern Roman Empire and Italy, this learning did not pass over into the Western countries until the 14th century, because the intellectual class had not yet been formed, and with it the conditions of the cultivation and development of learning were still wanting. Naturally Greek culture could only grow up in Western Europe in the same ratio as the civilisation of the populations approached that of Greek antiquity.

It can easily be proved that the civilisation of European populations continually increased after the decline of the ancient Greek states; but owing to peculiar circumstances, to which I will presently allude, it remained for a time without influence upon the progress of culture, *i.e.*, of its mental domain, and hence apparently a gap.

In reference to the share which inventions bear in the development of the conceptions and ideas in natural philosophy, it will be sufficient to draw attention to the facts that the true view of the motion of the earth and the planets originated with the invention of the telescope, and that all progress in astronomy depended upon the perfection of optical instruments. The invention of the telescope was preceded by that of colourless glass; the further improvement of optical instruments depended upon the invention of flint glass, and of the achromatic lens, which Newton thought impossible. By means of Galileo's instruments Uranus and the satellites of Saturn could not have been discovered. Copernicus looked upon his view not as "true," but as more simple and more beautiful, in the same manner as we take the notions of a physiologist of "good" and "beautiful," not in the meaning of true, as it is true that $2 \times 2 = 4$, but as "suitable" "profound," or "exhaustive." Chemical analysis resulted from the manipulations of the metallurgists, mineral chemistry from pharmacy and from chemico-technical manufactures, organic chemistry from medicine. The theory of heat has been amplified by the steam-engines, the theory of light by photography.

In astronomy the Greeks accomplished the utmost they possibly could with a simple, single sense; they discovered the law of reflection of light, the arithmetical laws of sound, the centre of gravity, the law of leverage and of hydrostatic pressure, and whatever could be deduced from these laws and astronomical observations by means of mathematics; any further progress was excluded by the degree of their civilisation. The source of the trade, wealth, and power of the Greek states in their most flourishing period was a highly developed, extensive industry; Corinth produced what we might call Birmingham and Sheffield goods; Athens was the centre of the products of manufactures now spread over Leeds, Staffordshire and London, such as woollen textiles, dye-stuffs, ceramic wares, gold and silver articles, and ship-building. The citizens were manufacturers on the largest scale, ship-owners and merchants who had their offices and factories on all coasts of the Black Sea and the Mediterranean; the men of science were the sons of citizens, and well-acquainted with manufactures, industry, and commerce. Socrates was a stonemason, Aristotle an apothecary (compounder of medicines and a medical man), and Plato and Solon were no strangers to trade. The men of science spoke and wrote in ancient Greece the same language as the tradespeople; in cultivation of the mind the latter were on a level with the philosopher, the difference consisted only in the direction of their knowledge; democratic governments and institutions united both in an intimate personal intercourse, and indeed the thirty-eight chapters of the "Problem" appear to be nothing else but questions of tradespeople, artists, musicians, architects, or engineers, which Aristotle tried to solve as far as his "derived ideas" permitted.

No other land in the old world combined in the same degree as Greece, up to the time of Pericles, in her social arrangements, in the close connection of the productive and the intellectual class, the necessary elements for the origin of science. But Greece was a slave state, and slavery was the bane which confined Greek civilisation within certain limits, and made them impassable. All products of the Greek manufactures were the result of slave labour. At the time when Athens flourished there were nearly 2000 slaves for every 100 citizens, which number gives us an idea of the extraordinary development of the Athenian industry.

Now a tradesman or artisan is not able to produce by himself alone more value than he requires for the very necessities of life for himself and family, but he must be able to command at will the strength of 20 or more people if he will realise an excess of products of industry large enough to satisfy the requirements

of part of the population of the land in which he lives, and all tradespeople in the land put together must produce a very much larger excess if their products are to become articles of export. This last proportion exists in all industrial commercial states, and it did exist in Greece, for the accumulation of wealth in precious metals in the country had not been effected by plunder, but by exchanging products of Greek industry in other countries for the people of which they had more value than gold or silver.

The progress in Greek civilisation chiefly depended upon the transition of the slave state into a free state, which cannot be imagined without the utilisation of natural forces by means of complicated tools or machinery which do the work of slaves.

It is evident that by the invention of machinery, which converts a given natural force, the weight of falling water for instance, into power of labour, and thereby performs the work of 20 people, the inventor may become rich and the slaves free men, and the natural consequence of the introduction of machinery is an increase in the productive class, and thereby in the number of inventors and an enlarged production of the country. But in a slave state the application of natural forces and the substitution of slave labour by machine work is almost impossible, for the profit and wealth of the possessing class in such a state consists in the slaves, and every single citizen sees his property *de facto* endangered by the introduction of machinery; and if the citizens, as then in Greece, form part of the authorities, government and people combine to make the existing state of slavery permanent, the government with the apparently wise intention of securing to the labouring population their livelihood.

The free man only, and not the slave, has the inward impulse and an interest to improve his implements or to design new ones, and thus the workman who builds up a complete machine generally participates as co-inventor. The regulator and other most important parts of the steam engine are inventions of workmen.

Any improvement in the methods of once established routine and manufacture by slaves (themselves working machines) is out of the question.

Liberty, i.e., the loosening of all bonds which prevents man from employing the powers bestowed upon him by God to his own best advantage, is the foundation and the principal condition for the progress of the human race in civilisation and culture.

A glance at China suffices to comprehend the influence upon a gifted people, resulting from simple exclusion of the natural forces in the execution of human labour by machinery; her high civilisation has thereby become stationary for the last 2000 years.

In England, and especially in the United States of North America, where antiquated institutions and laws, grown up from ignorance, do not impede the free employment of human forces, we see on the contrary a continuous increase in wealth, power and civilisation, and we can scarcely entertain a doubt that in the free states of North America all the elements exist to lead them to the highest scale of culture and civilisation attainable by men.

A modern state, in which free trade does not exist, in which the establishment or extension of a business depends upon the pleasure of ignorant officials, in which the free man is not allowed to choose the place he considers most suitable for the exercise of his powers, and in which he requires the permission of his masters to contract marriage,—this is the ancient slave state, in which the *élite* of the people is poor and without susceptibility for mental or moral improvement, and whose wealth and power form a deceptive varnish, easily rubbed off by slight friction.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

ROYAL DUBLIN SOCIETY.

At the last evening scientific meeting of this Society, Dr. De Ricci read a paper "*On the Japanese Oak-feeding Silk Worm*" (*Bombay Japonica*). The speaker's attempts to rear this worm in Ireland had been comparatively successful, and from the results obtained he was inclined to believe that this species of silkworm could be easily acclimatised. The oak was the indigenous tree of this island, and he firmly believed that with care it would be feasible to establish in this country the cultivation of this important silkworm, and thus create a new branch of industry and a new source of wealth. The great disadvantage that this worm laboured under in this climate was that the worms were hatched before the oak leaved. Dr. Wallace, of Colchester, had previously failed in hatching this worm.

Amongst an interesting collection of minerals which had been brought for the museum of the Royal Dublin Society was a remarkable specimen of flexible sandstone from Delhi. Although $\frac{3}{4}$ of an inch thick, this sandstone could be moved about in the air like a piece of ribbon, and exhibited either way a curvature of at least 5 or 6 inches from the original line occupied by the stone.

ACADEMY OF SCIENCES.

NOVEMBER 11, 1867.

(FROM OUR OWN CORRESPONDENT.)

Vacant Academic Chair.—The Imperial Observatory.—Functions of the Roots of Vegetables.—The November Meteors.—Parallax of the Sun.

In a letter to the President M. Dubrunfaut requested the Academy to insert his name in the list of candidates for the vacant chair in the section of rural economy, and promised to submit to it the numerous titles which he possesses for the honour which he solicits. He will be received, we are sure, with open arms as one of our most eminent practical chemists. M. Dubrunfaut at an early age imbibed a taste for agriculture, and worked at its elementary practice. Taking into consideration that the great source of the prosperity of France is the industrial development of the soil, M. Dubrunfaut made himself a manufacturing chemist. Every one knows the immense progress he has made in the production of beet-root sugar and alcohol; the benefits to be reaped by the application of osmose and the purification of beet-root juice and molasses will be counted by millions of francs.

M. Elie de Beaumont commenced the reading of three long letters relative to the autographs of M. Chasles, two from Sir David Brewster, and one from M. Grant. The Academy decided that they should be inserted in the *Comptes Rendus*. It is high time, however, to finish this discussion, and M. Balard begged of M. Chasles to cease answering these assertions, and M. Chasles promised to publish all the original documents.

M. Leverrier called attention in a long note to the inconveniences experienced by the observatory owing to the new streets and constructions in the neighbourhood of the Saint Jacques quarter.

M. Corenwinder read a memoir on the functions of the roots of vegetables. It has been long known that the roots possessed the property of absorbing carbonic acid. M. Corenwinder proves on the contrary by his experiences that if these organs are put in communication with a certain proportion of this acid, either in a gaseous state or in solution in water, it is found that the quantity present in the roots is greater than that which had been supplied to the plant.

NOVEMBER 18, 1867.

MM. Coulvier-Gravier and Chapelas communicated the following note on the falling stars of November. The first great appearance of this phenomenon noted dates from 1766; the second, of 1799, was observed by MM. Humboldt and Bonpland. Consequently, if these apparitions are truly periodical these two observations furnish a period of 33 years. But, since 1799, we must arrive at 1833 for the observation of a similar phenomenon which has served as basis for the calculation of Olbers, by which he thought he could prove that the period of the phenomena of November was definitively 34 years, and that the first return would take place in 1867. Now, we are forced to note that the illustrious astronomer had not made a correct statement, for this year, though the moon was bright and the atmosphere foggy, we were able to ascertain the presence of only a veritable minimum. Last year the apparition was very beautiful, though inferior to 1833, and many observers watched impatiently the return of the phenomenon, relying on the theory of Olbers. Now the period has arrived and all observers have been able to state that the expected phenomenon of November was not produced. The solution of this problem must be postponed for some years.

This year M. Le Verrier had organised the observation of the falling stars of November. He had them observed at several places, but the height of the moon above the horizon had rendered observation almost impossible. At Limoges the sky was overcast, and in Paris too brightly lit up by the moon. They only observed before two o'clock a few meteors; from 2h. 48m. to 5h. 42m. the number of meteors seen in the moonlight were constantly on the increase. In the last hour before daylight the number was 25. This gives reason to believe that the maximum occurred last year. M. Wolf observing that a great many did not come from the constellation Leo, concludes that the periodical meteors are unconnected with the sporadic ones.

The Academy proceeded to the nomination of the commission for drawing up the list of candidates for the chair rendered vacant by the death of M. Civiale, the Section is composed of two members of the Section of Mathematics, MM. Mathieu and Becquerel; two members of the Physical Science Section, MM. Lecaisne and Longet; two free Academicians, MM. Leguin and de Verneuil; under the presidency of M. Chevreul. The chances are in favour of Dr. Larrey.

M. Chasles made a further communication on the subject of the Pascal-Newton forgeries.

M. Chasles also communicated the translation of a memoir of an American astronomer, M. Simon Newton, with respect to the parallax of the sun. He gives it at 8'56; M. Leverrier adheres to 8'95, a value which agrees with that determined by M. Foucault.

F. MOIGNO.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, NOV. 19, 1867.

Curious Terrestrial Globe.—Organisation of the Imperial Observatory.—Report on Mr. Fryer's Concretor.—New Optical Instruments.

DURING the revolution of 1793 a curious terrestrial globe existed in the Royal Chateau de Bellevue. Becoming national, it was sold and bought by one named Testu. The latter person, after having lost his fortune, and not having room for it, deposited it in the Royal Library of the Rue de Richelieu. Later, M. Jomard, conservator, engaged M. Sanis to purchase this curious work, assuring him that, after being restored, the Government would purchase it for one of the museums. M. Sanis treated with M. Testu, and M. Jomard put him in possession of this globe so remarkable in an archaeological point of view,

and he has had it since 1846. The globe has remained, after being restored, so as to have lost nothing of its primitive character, in the hands of M. Sanis, who wishes to yield it to a museum in any country. It can be seen at No. 22, Rue des Fossés, Saint Jacques, Paris.

As to the origin of this globe, the works of Guache gave the idea to Edme. Montell of constructing a globe which would represent at the same time the natural and political divisions of the earth. In order to accomplish this double project, the inventor proposed to trace on an ordinary globe, three feet in diameter, all the details of the inequalities of the surface of the globe. The King, Louis XVI. (so says the "Universal Biography of Milan"), ordered the execution of this project at the expense of £1,200, defrayed by his Majesty.

This instrument consists of—1. A great outer globe divided into two hemispheres. The convex portion gives the political geography, and the concave portion the state of the heavens. 2. A globe in relief, a metre in diameter, rolls in the interior of the first, and represents continental and submarine mountains, basins, &c.

The decree for the organisation of the Imperial Observatory, dated January 30, 1854, contained the following:—"Every two years, at least, the minister receives a report stating the actual scientific situation and requirements, drawn up by a commission composed of two members of the Admiralty Board, a member of the Institute, two members of the *Bureau des Longitudes*, an inspector-general of superior instruction, and the director of the observatory. This excellent arrangement has remained a dead letter, the result being the enormous abuses whose extent can be known from the following facts. 1. The number of titular astronomers, calculators, and clerks, &c., who have passed through the Observatory without remaining in it between the years 1854 and 1867, exceeds a hundred. 2. Among those who have quitted the observatory there are many celebrated scientific men. 3. Several titular astronomers, the salaries of which ranged between £240 and £360 per annum, do the not perform any regular service. 4. That the amount of the salaries was fixed in the most arbitrary manner. 5. That the salaries of many astronomers were kept back even more arbitrarily. 6. That the future career of 6 or 7 pupils, of great merit, proceeding from the *Ecole Normale* of France, was seriously compromised by the engagements towards them not being carried out, &c. The minister of public instruction, being struck by this state of affairs, has named a commission to report on the state of the Observatory. Among the questions to be debated is the demolition of the present building and the construction of a new one.

M. Dubrunfaut has just made a report on his examination of the products obtained by the concretor of Mr. Fryer of Guadaloupe. He states that the mass is sufficiently ripe, and the crystals sufficiently detached to allow of refining processes being adopted, either by moulds or by the turbine. Its colour is inferior to the 4th class of good quality; and, observing the facility with which the syrup is displaced in the mass, he asks if the specimen which has arrived in Europe is the same as that which left Guadaloupe, or, in other words, if it has not been subjected to some purification which had sensibly altered its constitution. This species of cooked mass, in fact, does not appear homogeneous, and he thought it useful to reduce it to fragments, so as to mix them all together, and thus form a mass representing the true average.

The reporter first examined a colonial sugar classed as good 4th (No. 12 of the samples); the results are as follows:—

	P.centage.
Saccharimetric	91'35
Sugar (uncrystallisable)	3'65
Water	3'63
Ash corrected by the factor, 0'9 ..	0'85
Organic and non-saccharine matters	0'55
	100'00

The return of this sugar by refining is accomplished in the following manner:—Admitting 3'73 for the saline coefficient, as we also do for the indigenous sugar, and taking unity for the glucosic coefficient, as several refiners of Paris adopt—

$$0'85 \times 3'73 = 3'17 \text{ sugar}$$

$$3'65 \times 1'30 = 3'65$$

Sugar remaining in the molasses = 6'82

Sugar (refined) .. 91'35 - 6'82 = 84'53

Thus we have—

Crystallisable sugar	6'82	
Glucose	3'65	15'47
Water	5'00	
Refined sugar		84'53
		100'00

As the molasses are delivered by the refiners at 42° Beaumé, and at 50 per cent in all sugars, the return in molasses would be greater. But the difference compensates the loss, and the refiners ordinarily count upon cent per cent of return.

We can estimate the value of the sugar, in refining, as follows:—

84'53 loaf sugar at 1'25 f. the kilo.	f. c.
15'47 molasses at 26 f.	106 66
	4 02
	11 068

To be deducted

Duty on No. 12, less the drawback of	
39f. Expenses of refinery 9'75 the	
100 kilos., taking into account the	47'25
return in molasses—8'25	

Leaving 63'43

for the value in refinery, not including the profit of the refiner. This profit, given by the refining of ordinary sugars, can sometimes attain 8 or 10 fr. per 100 kilos. of the refined sugars, whilst the profit upon the white grained sugar is often negative.

The following is the result of the examination of the Fryer concreted sugar:—

Crystallisable sugar as ascertained by the saccharometer	78'00
Uncrystallisable sugar (Barreswill process)	9'10
Ash	2'80
Water	7'70
Other organic matters	2'40
	100'00

The returns of the sugar in Parisian refinery, calculated on the same basis as the good 4th above mentioned, give the following results:—

$$2'80 \text{ ash} \times 3'73 \dots\dots\dots 10'4 \text{ sugar}$$

$$9'10 \text{ glucose} \times 1 \dots\dots\dots 9'1$$

Total 19'5

sugar contained in the molasses.

Thus we have, as a maximum, in molasses	42
Extractible sugar	58
	100

This return may be valued in Paris (not including the profit of the refiner) as follows:—

58 kilos. of loaf sugar, at 1'25 fr.	fr. c.
42 kilos. of molasses	72 50
	10 92

Total 83 42

To be deducted, we have

Small duty, less the drawback, 37fr.	
Expense at 20f. the 100 kilos. refined,	47 60
11'60 f.	

Remaining for the value of the sugar .. 35 82

As a like produce would give relatively four times more molasses in refining than the average actual process, it would soon encumber the material with low produce, and would thus hamper the normal production. Several Paris refiners refuse systematically the purchase of every sugar producing more than three per cent of dross, that is to say, more than twenty per cent of molasses. What is to be done with those which give more than 40 per cent? It is probable that, in such a case, they would not consent to pay for this produce more than twenty to twenty-five francs the 100 kilos. in dépôt, although this sugar can render by refining the 35·82 francs above calculated.

If we wish to know, after the composition of concrete sugar and good 4th, what would be the return in concrete sugar No. 4 and molasses, we arrive at the following result:—

Extractible sugar calculated	58 per cent
Molasses	16
Or in good sugar No. 4	74 per cent
In Colonial Molasses	26
	100

The above 74 kilos. are worth, in Paris, 46·9 francs, to which must be added the value of 26 kilos. of colonial molasses; considering that the 74 kilos. of good 4th have paid less freight than 100 kilos. of Fryer concrete sugar, it is plain that there will be more profit in making good ordinary or white sugar at the Antilles, than in making the Fryer concreted sugar.

In fact, in a fiscal point of view, 100 kilos. of Fryer concrete sugar having paid a duty of 37 francs, and only producing in reality 58 per cent of refined sugar, the 100 kilos. of refined sugar thus produced are burdened with a tax of 63·80 francs, while the loaf sugar is only valued at 47 francs.

The same calculation applied to the good 4th does not burden the 100 kilos. with a tax exceeding 43·13 francs, that is to say, 16·67 francs less than the sugar of the concretor. M. Dubrunfaut does not recommend the adoption of the Fryer system into the French colonies, where the sugars are poor in refined sugar and rich in molasses, but he thinks it well adapted for the Antigua sugars. The sugars imported into England have given the following analysis in 100 parts: crystallisable sugar, 87·79; fruit sugar, 6·00; refuse, 0·81; water, 4·40, organic matter 1·00. A similar sugar assayed in Paris by the refiners gave on the same bases as those we have given above furnished: extractible sugar 78·7, molasses 21·3 in 100 parts.

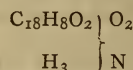
M. Robert Houdin has just published a very interesting pamphlet on new instruments suitable for the observation of the different organs of the eye, also the manifestation of entoptic images. These are the names given by him to the shadows thrown on the retina by intra-ocular bodies.

Seven instruments of this class have been invented by M. Robert Houdin; these are: 1. The *Iridoscope*, for the manifestation of entoptic images; 2. The *Diopscope* by the aid of which the inversion of the images on the retina are determined; 3. The *Pupilloscope*, demonstrating in a magnified form the dilations and contractions of the pupil; 4. The *Pupillometer*, which gives the diameter of the pupil to within a quarter of a millimètre; 5. The *Diopsimeter* for measuring the extent of the field of vision; 6. An *Optometer* for the use of any persons who wish to determine the distance of distinct vision; The *Retinoscope*, an instrument with which one can see the vascular group, in his own eye.

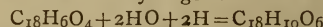
F. MOIGNO.

CHEMICAL NOTICES FROM FOREIGN SOURCES

Melilotic Acid.—C. Zwenger. Melilotic acid, which is found in *melilotus officinalis* partly in the free state, partly combined with cumarin, belongs to the salicylic acid series. When fused with potassic hydrate hydrogen is evolved and salicylic and acetic acid formed. Heated in a retort, two equivalents of water separate and melilotic anhydride, $C_{18}H_8O_4$, distils over. The acid is monobasic but diatomic; its salts mostly crystallise well. Dibrom-melilotic acid, $C_{18}H_8Br_2O_6$, is obtained by adding bromine slightly in excess to melilotic acid at ordinary temperature. This acid is crystalline, sparingly soluble in water, readily in alcohol or ether. The action of strong nitric acid gives rise to the formation of dinitromelilotic acid, $C_{18}H_8(NO_4)_2O_6$. Melilotamide,

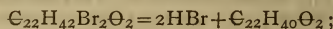


is formed by treating melilotic acid with ammoniac hydrate. Melilotic acid may be prepared artificially from cumarin by joining to the elements of the latter first two equivalents of water (converting it into cumaric acid), and then two of hydrogen:



This reaction is accomplished by treating cumarin in aqueous solution with sodium-amalgam.—(*Ann. Chem. Pharm. Suppl.*, v. 100.)

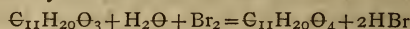
Erucic Acid, Derivatives of.—O. Kausknecht. Erucic acid was prepared by treating beet-root oil (Ruböl), with plumbic oxide, extracting the lead soap with ether, and decomposing the remaining plumbic erucate with chlorhydric acid. The action of alcoholic potassic hydrate upon erucic dibromide under pressure and 140°—150°C., gives rise to the formation of behenolic acid $C_{22}H_{40}O_2$:



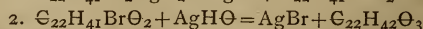
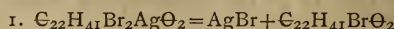
at ordinary temperature monobromerucic acid, $C_{22}H_{41}BrO_2$, is formed:



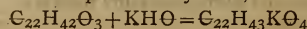
The dibromide of the latter, treated by this reagent loses two atoms of bromine, but whether monobromerucic acid is regenerated, or monobrombehenolic acid formed, has not been decided. Behenolic acid is soluble in water and in alcohol, and fuses at 57·5°; it unites with two or four atoms of bromine forming the bromides $C_{22}H_{40}Br_2O_2$ and $C_{22}H_{40}Br_4O_2$ (perhaps $C_{22}H_{38}Br_4O_2$). When heated with fuming nitric acid three bodies are obtained: 1. Dioxybehenolic acid $C_{22}H_{40}O_4$; monobasic, fusing at 90°—91°, insoluble in water and less soluble in alcohol than behenolic acid. 2. Brassylic acid, $C_{11}H_{20}O_4$; dibasic, scarcely soluble in water, soluble in alcohol or ether, fusing at 108·5°. 3. An oil, $C_{11}H_{20}O_3$, probably the aldehyde of brassylic acid, which may be converted into the latter by oxidation with bromine:



Erucic dibromide treated with freshly precipitated argentic oxide is converted into an oily mass which is a mixture of liquid oxyerucic acid, $C_{22}H_{42}O_3$, and solid dioxybehenic acid, $C_{22}H_{44}O_4$, the latter being obtained as a bye-product. The reaction proceeds in the following manner:



Oxyerucic acid is a heavy oil, insoluble in water, soluble in alcohol and ether. Dioxybehenic acid may be more readily prepared by boiling oxyerucic acid with an aqueous solution of potassic hydrate,



and decomposing the potassic dioxybehenate with chlorhydric acid. The acid is soluble in alcohol, and fuses at 127° . When erucic acid is boiled with diluted nitric acid it is converted into an isomeric compound, brassidinic acid, $\text{C}_{22}\text{H}_{42}\text{O}_2$, which is monobasic, fuses at 60° , and is less soluble in alcohol or ether than erucic acid. The dibromide of brassidinic acid is a crystalline compound, thus differing characteristically from the dibromide of the isomer, which shows no trace of crystallisation.—(*Ann. Chem. Pharm.* cxliii. 40.)

Copper, Determination of.—Lecoq de Boisbaudran. Instead of precipitating copper from solution, in presence of other metals, with zinc, the author proposes to effect its separation by means of an electric current. The slightly acid solution of the sulphates of copper and other metals is contained in a platinum crucible which forms the negative pole of an electric current from two of Bunsen's cells; the positive pole terminates in platinum foil, and passes through a perforation in a watch-glass which covers the crucible, dipping into the liquid. The copper separates in a perfectly pure state, and the reduction is accomplished in three or four hours. Intensity of current, concentration of solution, temperature, and amount of free acid may vary within wide limits without impairing the accuracy of the result.—(*Bull. Soc. Chim.* vii., 468.)

NOTICES OF BOOKS.

Geschichte der Chemie. Bearbeitet von Dr. TH. GERDING, Leipzig, 1867. (*History of Chemistry, by Dr. T. GERDING.*)

THIS is a highly interesting and valuable contribution to the literature of chemistry. It is avowedly founded on the classical work of H. Kopp, published in four volumes in 1843-47; but it differs from it, not only in its smaller size, but also to some extent in its arrangement. Part I., which occupies nearly half the book, is entitled "General History of Chemistry; or, Historical Development of Chemical Science with respect to the most important Chemists and their Labours." This, the true history, is divided into four periods. The first, which may be distinguished as the ancient period, brings us down to A.D. 400. The second, the mediæval, extends to the 17th century, and is subdivided into separate histories of alchemy and of medical chemistry, which last may be said to have commenced with Paracelsus in the commencement of the 16th century. The third and fourth periods comprise modern chemistry. The former extends from the middle of the 17th to the end of the 18th century, and contains the reign of the celebrated phlogistic theory; while the latter, which occupies nearly one quarter of the entire book, is the "quantitative age," the short but brilliant career of true chemistry. This last section is particularly valuable to the modern chemist, for not only does it present us with succinct sketches of the lives and labours of the earlier chemists of the century, Lavoisier, Dalton, Gay Lussac, Davy, Berzelius, &c.; but it reviews with great impartiality, and, on the whole, with great exactness, the researches of many of the chief living chemists, and the English reader will notice with pleasure the names of Graham, Stenhouse, Anderson, Gladstone, and many other distinguished fellow-countrymen. We are indeed compelled to remark some glaring omissions, such as the absence of all notice of Andrews, Baeyer, Cannizzaro, Frankland, Odling, Zinin, and a few others of equal celebrity; but when we consider the extent of the plan and the smallness of the book, we cannot wonder at finding some blemishes.

The second part of the work is of even more practical importance. It is entitled "Special History of Chemistry; or, History of the most important Doctrines, Theories, and single Substances." Under each head we find a clear

though brief summary of the chief discoveries which have been made upon it. Thus under nitrogen (page 365) a very interesting account is given of the views which have at various times been taken, not only of the nature of nitrogen itself, but also of some of its chief compounds. We might give many similar instances, and should be glad, if space permitted, to give some extracts from the book. As it is, however, we can only commend it to the notice of our readers, and express our opinion that an English translation would meet with a favourable reception.

Pharmaceutical Chemistry. By JOHN ATTFIELD, Ph.D., F.C.S. London: John Van Voorst, Paternoster Row. 1867.

DR. ATTFIELD'S Chemistry has for its object the thorough teaching of Pharmacy and Chemistry as applied practically to Pharmacy; professedly and indeed truly it is a guide-book. The information conveyed in the text is mainly that which cannot be learnt by experiment, such as the derivations of words and terms, the places whence different materials, pharmacal or chemical, are derived, with some of the various theories lately advanced upon the composition of somewhat complex drugs, *e. g.*, bismuth carbonate, goulard water, and tartar emetic. The work being of the size of the British Pharmacopœia of 1867, and mainly founded upon it, forms, in many instances, a really invaluable commentary to it. Thus the symbolic expressions in the Pharmacopœia, called by courtesy the formulæ of compounds according to the new system, with their old names, (truly a most characteristic example of a compromise)—formulæ which are neither rational or empirical—with Dr. Attfield's aid are presented to the student in a somewhat more intelligible form. The expressions of the Pharmacopœia, such as $2(\text{Bi}_2\text{CO}_3)_2\text{H}_2\text{O}$, are here translated into a form reconcileable with the trivalent character of bismuth. The most modern expressions of chemists are used throughout the text, thus we meet with trivalent, &c., and equivalent is very well explained to the student as opposed to atoms and molecules.

We cannot, however, say that Dr. Attfield has had the same success in the consistency of his nomenclature. When new words like mercurous and mercuric salts are explained to the pharmaceutical chemist, who has to connect the ideas with compounds like calomel and corrosive sublimate, they should be strictly limited to metals like mercury, that have two classes of salts; other salts should have names consistent with their formulæ, or already familiar to the pharmacist or dispenser. Thus when the student reads of calcic carbonate and calcic oxalate (p. 417), he compares them in his mind to mercuric carbonate, and mercuric oxalate, concluding justly enough that there is a calcous carbonate and calcous oxalate. This is more particularly the case, from the expressions, sulphate of calcium, carbonate of calcium, and nitrate of potassium being almost invariably used in the text. Again, under lead, there is no plumbous oxide, it being called oxide of lead, although plumbic peroxide is shortly after mentioned.

In our opinion the most valuable part of the work is that devoted to the preparations of the alkaloids and active principles, the most difficult thing that the student of *materia medica* has to learn. The reason for every successive process is given fully, and, what is more, accurately and clearly. The many excellent features of Dr. Attfield's book would have been increased had more attention been devoted to the spectroscopic and saccharometer. To this might be added in a future edition a discussion of chemical organic compounds not actually mentioned in the British Pharmacopœia, but of the greatest value in full detail.

As it is, Dr. Attfield's book is written in a clear and able manner; it is a work *sui generis* and without a rival; it will be welcomed, we think, by every reader of the Pharmacopœia, and is quite as well suited for the medical student as for the pharmacist.

CORRESPONDENCE.

THE CAMPHOR STORM GLASS.

To the Editor of the Chemical News.

SIR,—The question put by your correspondent (p. 245) as to the origin of the oily looking layer sometimes seen at the top of the liquid column of the storm glass, admits of a ready answer. I have often noticed this oily looking layer. It is never formed, I believe, except when the glass has been exposed to the heat of the sun, so as to liquefy a considerable portion of the solid contents. These consist of nitre, sal-ammoniac, and camphor. The first two are taken up by the water of the composition, and the last by the spirits of wine, in quantities varying with the temperature. Now, while the tube is being warmed by the sun, a portion of the alcohol distils to the upper or air-filled part of the tube, and when the sun goes off the window and the tube cools, the vapour condenses into strong alcohol, the solvent powers of which for camphor are much greater than the spirits of wine originally employed. This alcohol, then, in settling down becomes saturated with camphor, and forms a well marked layer at the top of the liquid column.

This effect may be very well shown by the following contrivance:—Put into a long test tube a quantity of nitre or sal-ammoniac; fill the tube one half with water. There should be more salt than the water can dissolve. Next put the tube into a gallipot containing warm water and standing on the hob. When the tube is quite warm, fill it up with strong camphorated spirit, leaving room for a well fitting cork and a little air. Shake up the contents and return the tube to its warm water bath. After a short time a well-defined oily looking layer, from two-tenths to five-tenths of an inch in thickness, will be seen at the top of the liquid column. If crude sal-ammoniac be the salt used the colour of this layer will be yellow passing into brown, due probably to a trace of iron in the salt. If pure nitre be used, the layer will be colourless. That this layer really consists of a very strong alcoholic solution of camphor may be shown by dipping into it a cold glass rod which will be quickly encrusted with solid camphor. If the tube be left to cool undisturbed small camphor stars will be formed, and circulate in regular order within the oily looking layer. The effects vary according as nitre or sal-ammoniac be used, but they are very pretty in either case.

This I believe to be the best explanation of the phenomenon in question. There is, however, a strong tendency to stratification in materials of such different densities, when in consequence of a gentle heat, such as that of the sun and of slow cooling, they are allowed to settle down. I have noticed three and even four distinct layers in a tube containing only nitre and camphorated spirit. If the storm glass be exposed to a fierce sun its contents will in cooling be so far separated that before the glass will act properly it must be inverted and shaken. It will then require a day or two of repose before its usual phenomena are exhibited.—I am, &c., C. TOMLINSON.

King's College, London, November 15, 1867.

MISCELLANEOUS.

Transparency of Molten Metals.—The assertion of Secchi, a few months ago, regarding the transparency of heated iron, has given rise to much talk; but we have not yet seen it confirmed by the statement of any other competent eye-witness. Meanwhile, however, many assertions have been made as to the transparency of metals when melted; and the evidence on this point begins to stagger the savans. It so happens, that, so far as we are aware, no professional chemist or educated physicist has yet testified to the

phenomenon as actually observed by him. It is merely said, in various quarters, to be a fact, well known to the workmen employed in melting and moulding certain metals. We deem it, therefore, important to mention the first authentic endorsement which has come to our notice. M. Paul Morin, the accomplished chemist in charge of the Aluminium Bronze Works near Paris, asserts that the melted alloy, when poured into the mould, is transparent; and Mr. T. Sterry Hunt, to whom the assertion was made, and who saw the operation performed, assures us that the appearance of the molten stream seemed to corroborate the statement. There is a possibility of optical illusion in the inspection of a body which is itself intensely luminous, to discover whether it is transparent. We suggest that the question may be easily settled by the means employed to show the transparency of ordinary flame, namely, by burning magnesium, or in some other way producing a more brilliant light, behind it. The aluminium bronze is remarkable for two things, among other qualities, which distinguish it from ordinary alloys. One is the intense temperature developed by the union of the two metals, and the other is the extreme fluidity of the molten compound. Perhaps these qualities may be connected with the alleged phenomenon of transparency. Copper may also be transparent in the liquid state; but, in pouring it into moulds, it often oxidizes very rapidly; and the whole liquid mass is believed to be filled with disseminated particles of the red oxide of copper, which is opaque. Whether from this cause or not, we cannot say, but the evidence as to the transparency of molten copper, as likewise in the case of other metals, is still conflicting and inconclusive.—*American Journal of Mining.*

Composition and Quality of the Metropolitan Waters in October, 1867.—The following are the Returns of the Metropolitan Association of Medical Officers of Health:—

Water Companies.	Total solid matter per gallon.	Loss by Ignition.*	Oxidisable organic matter †	Hardness.		Organic and other ammonia.
				Before boiling.	After boiling.	
Thames Water Companies.	Grains.	Grns.	Grains.	Degs.	Degs.	Grains.
Grand Junction	19'67	1'00	0'56	13'5	4'5	0'004
West Middlesex	16'67	0'85	0'52	12'5	4'0	0'004
Southwark and Vauxhall	18'50	1'00	0'59	13'0	4'5	0'004
Lambeth	19'00	1'25	0'60	13'5	4'5	0'004
Other Companies.						
Kent	27'50	0'75	0'26	18'0	7'5	0'000
New River	17'00	0'25	0'31	12'0	3'0	0'001
East London	19'20	0'50	0'49	13'0	4'5	0'001
Surface Wells in City.						
Idol Lane (Church)	87'33	2'00	0'06	32'0	16'0	0'004
Leadenhall Street.	120'00	11'51	1'51	50'0	—	1'281
Dunning's Alley	74'67	8'00	0'96	36'0	—	0'008

* The loss by ignition represents a variety of volatile matters, as well as organic matter, as ammoniacal salts, moisture, and the volatile constituents of nitrates and nitrites.

† The oxidisable organic matter is determined by a standard solution of permanganate of potash—the available oxygen of which is to the organic matter as 1 is to 8; and the results are controlled by the examination of the colour of the water when seen through a glass tube two feet in length and two inches in diameter.

CONTEMPORARY SCIENTIFIC PRESS.

Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News."

Poggendorff's *Annalen der Physik*.
No. 6, 1867.

R. BUNSEN, "On the Temperature of the Flames of Carbonic Oxide and Hydrogen." A. TOPPLER, "Optical Studies by the Author's new Method." B. RIEMANN, "Contributions to Electrostatics: On the Connection of the Law of Electricity and Magnetism with those of Light and Radiant Heat." L. LORENZ, "On the Identity of Luminous

Vibrations and Electric Currents." C. RAMMELSBURG, "On the Phosphites." H. W. SCHRODER VAN DER KOLK, "On the Mechanical Energy of Chemical Action." F. ZIRKEL, "On the Microscopical Constitution of the Phenolites."

Annalen der Chemie und Pharmacie.

August, 1867.

E. VON GORUP-BESANZ, "Researches on Rhenish Beechwood Tar Creosote." E. MENZNER, "On the Salts of Sulphophenic Acid." GLUTZ, "On some Chlorinated Derivatives of Phenol." GLUTZ, "A simple Method of preparing Chlorosulphonic Acid." T. MEVES, "On Oxethylene-sulphurous Acid, and on a new Method of Forming Isanthionic Acid." T. MEVES, "Researches on some Salts of Cyanacetic Acid." R. OTTO, "On the Bye-products obtained during the Preparation of Benzolsulphurous Acid." R. OTTO, Note on the Preparation of Cyanurate of Sulphobenzide." H. HUBNER, J. OHLY and O. PHILIPP, "On the Isomerism of the Aromatic Acids."

Journal für Praktische Chemie.

No. 13, 1867.

G. MERZ, "On a Method of Intensifying the Light given out by Sulphur when burnt in Oxygen." "An improved Method of Exploding Mixtures of Hydrogen and Oxygen." "A Method of showing the different Temperatures at which various Gases take fire." "An instructive and Simple Experiment on Diffusion." "A Method of collecting the Products of Combustion of Gun Cotton, and of demonstrating the Presence therein of Peroxide of Nitrogen and Carbonic Oxide." "A Method of Demonstrating the Production of Carbonic Oxide during the Decomposition of Carbonic Acid by Incandescent Charcoal." "On the Behaviour of Carbonic Acid towards Water at High Pressures." "A Method of showing the Variation in the Illuminating Power of Flames when separate and when combined into One Light." "On the Combination of Hydrogen and Chlorine under the Influence of the Magnesium Light." "On the Use of Glycerine for Preserving the Gelatinous Mass obtained by treating Bone with Dilute Acids." "Apparatus for Showing the Igniting Points of Various Substances." "A Method of Preparing Starch Papers for the Detection of Iodine." "A Method of Demonstrating the Formation of Chloride of Sodium by the Action of Sodium on Hydrochloric Acid." "On the Property possessed by Bichromate of Ammonia of assuming, when heated, an appearance resembling Tea Leaves." "On the Chemical Toy known as 'Chinese Grass Paper.'" "On the Increase in the Explosive Power of Gun Cotton and Gun Paper when Treated with Bichromate of Potash." "On the Fluorescence of Uranium Glass by the Magnesium Light." "On a simple Method of Preparing Ferrate of Potassium." "On a rapid Method of Preparing a Solution of a Salt of Manganese." "A Method of Distinguishing the Yellow Sublimable Oxide of Lead from that of Oxide of Bismuth obtained on Charcoal before the Blowpipe." "An experiment showing the rapid Reduction of Heated Oxide of Copper to Metallic Copper by means of Alcohol." "On a Method of causing the Ignition of Illuminating Gas by Spongy Platinum." "On the Fluorescence of certain Coloured Glass when viewed by Reflected Sunlight." "A Method of Imitating Red Glass." "On a Method of showing the Different Colours of Solutions containing small quantities of freshly precipitated Gold." BOETGER, "On the Crystallisation of Supersaturated Solutions of Acetate of Soda." "On a new and delicate Test for Alkalies and Alkaline Earths." "On some new Voltaic Batteries." "On the Occurrence of Peroxide of Thallium during the Electrolysis of Thallium Compounds, and on the Possibility of using that Body for the Manufacture of Matches." "On the Use of Solutions of Silicate of Soda for producing Arborescent Crystals of Metallic Salts." "On the Action of Lead on Distilled Water." J. DOEGEL, "On the Presence of Volatile Fatty Acids in the Gall." G. MERZ, "On the Volumetric Estimation of Acetic Acid." F. GAUHE, "Is the Product of the Action of Iodide of Phosphorus on Aqueous Picric Acid, Iodide of Pikrammonium, or Triamidophenol?"

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

2919. J. Cubitt, Claremont Place, Brixton, Surrey, "An improved process and composition for the preservation from decay of stone, brick, plaster, metal, and other substances, and for hardening or glazing their surfaces, so as to prevent smoke or dirt from adhering to them."—Petition recorded October 17, 1867.

2997. C. W. Harrison, Oberstein Road, Clapham Junction, Surrey, "Improved means of preventing incrustation in boilers and other vessels in which water is heated."—October 24, 1867.

3051. G. Davies, Serle Street, Lincoln's Inn, Middlesex, "An improved mode of preventing incrustation in and removing it from steam boilers."—A communication from J. J. Allen, Philadelphia, Penn., U.S.A.—October 30, 1867.

3064. W. S. Dixon, Bellisle, Ayrshire, N.B., "A new process of producing a blue dye or colouring matter."—October 31, 1867.

3105. J. Kidd, Paul's Wharf, London, "Improvements in obtaining artificial light, and in the apparatus employed therein."

3108. W. R. Lake, Southampton Buildings, Chancery Lane, "An improved artificial compound chiefly designed for use as a substitute for india-rubber or caoutchouc."—A communication from A. G. Day, Seymour, Conn., U.S.A., November 4, 1867.

NOTES AND QUERIES.

It has been represented to us that our column of Notes and Queries has occasionally been made the vehicle for the surreptitious disposal of trade secrets by subordinates in chemical works, unknown to their principals. This column has proved to be sufficiently useful to a large class of our readers for us to be reluctant to discontinue it for the sake of a few who abuse its privileges. Probably a more rigid supervision will enable us to obviate the difficulty. There will be no objection to a correspondent asking for information on trade subjects; but the answer must likewise be made public, and in such cases no name or address can be given, no private communications forwarded through us, and no offer of payment for information can be published.

Clarifying Caustic Soda.—Would any of your correspondents be good enough to instruct me what method I must adopt to clarify caustic soda solution of the dark-brown substance, and other impurities, which are sometimes associated with it. When I make the solution and causticise with lime, the carbonate of lime falls to the bottom, leaving a solution, deeply coloured red or brown (instead of colourless and clear), which is exceedingly inconvenient.—GEORGE JOHNSON.

Granular Effervescent Citrate of Magnesia.—The medicine known as "Effervescent Citrate of Magnesia" contains no citrate of magnesia of the chemist at all. It is nothing more than citro-tartrate of soda of the British Pharmacopoeia with an addition of sugar and four or five per cent of sulphate of magnesia. The magnesia can be detected by adding to a solution of the granules, ammonia, and tribasic phosphate of soda, when a precipitate of ammonio-phosphate of magnesia is almost immediately formed. The presence of the sulphuric acid in combination with this base can be detected by a solution of chloride of barium acidulated with hydrochloric acid, which gives an insoluble precipitate of sulphate of baryta.—C. UMNEY.

Granular Effervescent Citrate of Magnesia.—"A Surgeon" is quite right in supposing that there is no magnesia at all in the above preparation, indeed in many instances the two particular substances which are conspicuous by their absence are *magnesia*, and *citric acid* (!) while some varieties I have examined I found to contain bisulphate of sodium in place of the vegetable acid. One of the select samples was "warranted to contain no acid besides citric," an assertion which was of course in one sense true. I have always believed that the absence of magnesia from the so-called "citrate" was "widely known," if not, the sooner the facts are published the better.—WENTWORTH L. SCOTT.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the CHEMICAL NEWS will shortly be removed from Wine Office Court, Fleet Street, to

BOY COURT, LUDGATE HILL, E.C.

P. Holland.—Received with thanks; we shall be glad to hear further from this correspondent.

J. Johnstone.—The article has been in type for several weeks. It shall be inserted as soon as we have room for it.

James O.—Precipitate the silver in a plate of copper.

Olinthus.—Mr. Campbell has detected arsenic in the beds of some rivers.

Chromo-technist.—An account of Mr. Sorby's researches on micro-spectroscopic analysis appeared in our columns some time ago.

A Subscriber.—We have asked the publisher for an explanation respecting the missing sheets in the Dictionary.

Communications have been received from Professor Weltzein; Yates; M. Murphy; T. Fox (with enclosure); Dr. Gilbert, F.R.S. (with enclosure); T. Bourne; T. Miller; W. Schofield; J. Smith (with enclosure); M. B. Bywater (with enclosure); Rev. C. W. Kett; F. Armstrong; W. Lovatt; J. A. Walkden; H. Russell (with enclosure); Professor Gustavus Hinrichs, Iowa (with enclosure); Dr. W. Allen Miller, F.R.S.; S. Wright; J. A. Brand; J. Samuelson; S. Chambers (with enclosure); W. Gillett; J. Brown (with enclosure); F. Bromley; W. Wingrove; Dr. R. Angus Smith, F.R.S.; W. Isbister; Dr. A. E. Sansom; F. O. Ward (with enclosure); J. Spiller; I. Baggs; Professor Gamgee; G. W. Simpson; H. Kinnaird Yorke; M. Moncreiff Pattison; C. R. C. Tichborne; S. E. Phillips (with enclosure); H. N. Draper; J. Cliff; Kingsbury & Co. (with enclosure); J. Heywood; W. Hall; Liebig's Extract of Meat Co.; Dr. Tilbury Fox; E. W. Bartlett; W. H. Harris; Dr. F. Wehlems; W. Hoe; C. Tomlinson.

Books Received.—"Mining and Scientific Press." "Scientific American." "American Artisan." "American Journal of Mining." "The Journal of Materia Medica." "The Journal of Gas Lighting." "Moniteur Scientifique." "The Colonial Mail." "The Produce Markets' Review." "Naquet's Modern Chemistry," translated by W. Cortis and Revised by T. Stevenson, M.D. London: Henry Renshaw. "A Programme of Atomechanics, or Chemistry, as a Mechanics of the Panatoms," by Gustavus Hinrichs. "The Microscope in Geology," by David Forbes, F.R.S. "The Bible and Science," by William Allen Miller, M.D., LL.D., Treas. and V.P.R.S. "The Darwinian Theory Examined," by a Graduate of the University of Cambridge. London: James Nisbet and Co., Berners Street.

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MR. BRAITHWAITE'S Laboratory, which has been enlarged during the recess, will be re-opened at 10 a.m. for Instruction in Practical Chemistry as applied to Pharmacy, Medicine, Analysis, &c. Pupils can enter at any period. Terms moderate.

THE CHEMICAL and TOXICOLOGICAL CLASS meets as usual every Monday and Thursday Evening, at 8 p.m., commencing October 3rd.

THE LATIN CLASS for the reading of the Pharmacopœia, Physicians' Prescriptions, &c., every Tuesday and Friday Evening, at 8 p.m., commencing October 1st.

THE BOTANICAL and MATERIA MEDICA CLASS, every Wednesday and Saturday Evening, at 8 p.m. The usual **EXCURSIONS** for the **STUDY of PRACTICAL BOTANY** will commence at 10 a.m., October 2nd.

Fee to either of the above Classes Half-a-Guinea per Month; to the Botanical Excursions only. Half-a-Guinea per Eight Lessons, payable in advance. Pupils can enter at any period.

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THE CHEMICAL NEWS.

VOL. XVI., No. 417.

ON GAS ANALYSIS.

By Drs. GRANDEAU and TROOST.

I. Mixture of Oxygen, Carbonic Acid and Nitrogen.

—O, CO₂, N.

1. Introduce a portion of the mixture into a graduated tube over the mercury trough, and note accurately the volume.

To estimate the carbonic acid, pass into the tube, by means of a curved pipette, a small quantity of a concentrated solution of potash, and agitate several times until there is no further variation in the level of the liquid; the carbonic acid will be absorbed by the potash. To obtain the volume very accurately, transfer the tube to a vessel of water so as to allow the alkali to fall out; then re-transfer the gas to another tube and determine its volume, saturated with moisture.

To estimate the oxygen, first introduce into the tube a concentrated solution of potash, then a little pyrogallic acid. Upon agitation, the oxygen is absorbed, and the nitrogen remains. The amount of the latter gas may be obtained by taking the same precautions as in the former instance.

After having determined the volume of carbonic acid, phosphorus may be employed to absorb the oxygen. The experiment may be performed in two ways.

a. *In the Cold*.—In the tube containing the gas (over mercury) pass up a long stick of moist phosphorus, the sides of the tube being at the same time moistened. The oxygen combines with the phosphorus, giving phosphorous acid, which dissolves in the water. At the end of an hour the absorption is completed. It may be known by the absence of white fumes on the stick of phosphorus. Remove the latter, dry the gas, and measure its volume; it will be the nitrogen.

b. *With Heat*.—The analysis is effected much more rapidly in the following manner:—In a curved tube containing the mixture of oxygen and nitrogen standing over water, introduce by means of an iron wire a small piece of phosphorus, so that it rests on the upper curved portion of the tube; then remove the iron wire and heat the phosphorus, at first carefully, to volatilise the water which remains in the bend of the tube, and then rapidly, so as to inflame the vapour of phosphorus. A greenish flame will be seen to advance, gradually absorbing the oxygen of the air. When it has descended to the level of the liquid it disappears, and the experiment is terminated. Allow it to cool and determine the volume of the residual nitrogen.

2. The analysis of a mixture of carbonic acid, oxygen, and nitrogen may be effected with a little more accuracy in the following manner:—The dry mixture being contained in a graduated tube standing over mercury, introduce a piece of caustic potash fixed to the extremity of a platinum wire, and slightly moistened. When the carbonic acid is absorbed, withdraw the piece of potash, and a simple observation gives the residual volume of the mixed oxygen and nitrogen perfectly dry.

This residue is introduced into a mercurial eudiometer. This consists of a glass tube about 2 centimeters in diameter, having two platinum wires melted through the upper part terminating exteriorly in a loop, and curved inside in such a manner as to have their extremities opposite to each other, and one or two millimeters apart, across which the spark passes.

Add to the mixture double its volume of hydrogen, and pass the electric spark. Water will be produced by the

combination of the hydrogen and oxygen in the proportion of two volumes of the former to one volume of the latter. One-third of the diminution in volume represents, therefore, the volume of oxygen. The volume of nitrogen is obtained by difference. It is the excess of the original volume of the mixture over the sum of the volumes of oxygen and carbonic acid.

The estimation of oxygen by the eudiometer is not exact unless this gas is present in tolerable quantity in the mixture. If there is only a very small proportion, it is necessary, in order to ensure complete combustion, to take the precaution to introduce into the mixture a sufficiently large quantity of oxy-hydrogen gas, obtained by decomposing acidulated water with three or four Bunsen's elements. The gas should be passed through concentrated sulphuric acid in order to dry it.

II. Mixture of Oxygen, Hydrogen and Nitrogen.

—O, H, N.

1. After having measured the volume of the mixture, absorb the oxygen by potash and pyrogallic acid, or by phosphorus as described in section I.

Pass the remainder into a curved tube over mercury and introduce into it a piece of compact oxide of copper,* and heat it for about twenty minutes, all the hydrogen is then absorbed; the residue will be nitrogen: it may be transferred to a graduated tube, and its volume measured.

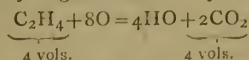
After the absorption of the oxygen the hydrogen may be estimated by introducing it into the eudiometer with half its volume of oxygen. Two-thirds of the diminution of volume occasioned by the passage of the spark represents the volume of hydrogen. The nitrogen is given by difference.

2. The analysis may also be effected entirely by the eudiometer. Introduce the original mixture into the eudiometer with twice its volume of hydrogen, and pass the spark. The volume of hydrogen which enters into combination will be two-thirds the diminution of volume, the oxygen being represented by the other third. This first experiment will therefore give the amount of oxygen. In order to ascertain the amount of hydrogen in the mixture, add to the residue of the first explosion half its volume of oxygen, and pass the spark a second time. Two-thirds of the diminution of volume will be hydrogen. The excess of the sum of the volumes of hydrogen burnt in these two experiments, over the volume of this gas introduced into the eudiometer, represents the volume of hydrogen found in the original mixture. The nitrogen will still be given by difference.

III. Mixture of Hydrogen, Carburetted Hydrogen, and Nitrogen.—H, C₂H₄, N.

Introduce the mixture into a mercurial eudiometer with twice its volume of oxygen, and pass the spark. The free hydrogen, and that in the carburet, combine with the oxygen to form aqueous vapour which condenses. The carbon becomes carbonic acid. The residue is therefore a mixture of nitrogen, oxygen, and carbonic acid.

Pass these gases into a graduated tube, and after having observed the volume, absorb the carbonic acid with potash. The diminution of volume gives the volume of carbonic acid, which is precisely equal to the volume of the carburetted hydrogen, as shown by the equation:



If a little pyrogallic acid is then introduced into the potash, the rest of the oxygen is absorbed, and the volume of nitrogen is obtained as a residue.

* M. H. Ste-Claire Deville prepares this compact oxide by fusing 2 parts of oxide of copper with 1 part of oxide of lead. The fused mass is run on to a plate of copper, then broken into pieces and preserved in bottles.

As to the hydrogen which existed in the free state in the original mixture, its amount is obtained by taking the excess of the volume of the original mixture over the sum of the volumes of nitrogen and carburetted hydrogen.

(To be continued.)

ON

SOME POINTS IN CHEMICAL NOMENCLATURE.*

By A. V. HARCOURT, M.A., Lee's Reader in Chemistry.

ONE of the dangers against which the advancing sciences need to be always on their guard is that of mistaking verbal for real questions. An example of this well-known truth is furnished by a controversy, which has been carried on among chemists in an intermittent fashion during several years, and which has recently broken out afresh.

The subject of the controversy is the question, What is an acid? As to the meaning of the name there is a tolerable agreement, though no chemist would attempt to state it with scientific precision. The only appeal is to the popular use of the word. By an acid, I suppose we mean a sour, corrosive substance, which changes vegetable colours, and effervesces with carbonated alkalies and is neutralized by them. At any rate an acid ought to have most of these properties. It has happened, however, that by a process very common in the history of scientific nomenclature, many substances have been likened, on other grounds, to those which this description applies, and have thus received the name of acid though devoid of these properties; while, on the other hand, many substances having all these properties are by common consent excluded from the acid class. But the controversy does not originate in this border land. It relates to some of the most typical and best known acids. Different chemists apply to different substances the familiar names of sulphuric acid, nitric acid, carbonic acid.

Formerly these names, which may be taken as examples of the class, were applied to particular oxides of sulphur, nitrogen, and carbon. But the founders of the unitary system of chemistry, laying stress upon the facts, (1) that these substances exhibited their characteristic properties only in the presence of water, (2) that some well-defined acids while having hydrogen in their composition were devoid of oxygen, transferred the name of acid from these oxides to their actual or supposed hydrates, and assigned to the oxides thus dispossessed the name of "anhydrides." This system having met with general acceptance among scientific chemists, the change of nomenclature has also been widely adopted.

Quite recently one of the foremost of English chemists, Dr. Williamson, in a manual published at the University Press, has reverted to the ancient practice, objecting to the name of "anhydride" as unmeaning, and insisting on the advantage of co-ordinating, in each series, hydrogen salts with metallic salts instead of separating them under a distinctive name. This retrograde proposal has naturally been controverted by the adherents of the prevailing system, and thus it is now more uncertain than ever what substance a chemist means when he speaks, for example, of sulphuric acid. All discussion, Gerhardt says, remains necessarily sterile when the disputants are agreed as to facts and differ only about the meaning of words. In this case, I venture to think the best solution of the controversy may be to discontinue the use of the word "acid" as a specific name for a particular class of substances, and to apply it only as a descriptive term to any substance having the properties which the word connotes. The name of oxide appears perfectly applicable to, and sufficient for, all

those substances which have been called "anhydrous acids," and it appears positively mischievous to distinguish the acids from the other salts of a series. In order to determine what particular name these oxides and salts should receive, it is necessary to decide some much more general questions of nomenclature, as to which there is at present great difference of opinion among chemists.

I should exceed the limits I have undertaken to observe, if I attempted to offer a criticism upon the various names that have been proposed for these classes of substances, but I shall venture to state what names appear to me to be the best, and shall endeavour to offer some reasons for my conclusions. The name of "carbonic acid," for the substance whose symbol is CO_2 , is perhaps too well established ever to be changed, but for a systematic name I should prefer "carbon dioxide;" and similarly for anhydrous sulphuric acid and anhydrous nitric acid I would substitute "sulphur trioxide" and "nitrogen pentoxide." To the salts of these acids, as they are called, I would give such names as "sodium carbonate," "nickel sulphate," "silver nitrate;" and the hydrated acids I would, upon the same principle, call "hydrogen sulphate," "hydrogen chloride," "hydrogen phosphate," &c.

Two sets of names are more familiar than these: (1) "binoxide of carbon," "sulphate of nickel," &c.; and (2) "carbonic binoxide," "nickelic sulphate," "hydric chloride," &c. To the first it has been objected that the use of the preposition "of" is incorrect, being in fact a too literal translation from the French. "*Carbonate de soude*" no more ought to have been rendered "carbonate of soda," than "*table de bois*" should be translated "table of wood." Accordingly chemists are now accustoming themselves to give up this usage which had acquired a formidable prescription. As to the second set of names, I see no advantage in adding the adjectival termination except where it is desired to prefix a numeral or to distinguish a class of salts by one or other of the terminations "-ic" or "-ous." In these cases, which are comparatively few, such terminations might be used without rendering it necessary to employ them in other cases. It is to be objected to them that they necessitate the use of Latin names in many cases instead of English, as "argentic" for "silver," or are tacked on barbarously to words which are not Greek or Latin, as in "nickelic," "zincic," &c. Further the special use of these terminations, to indicate which of two classes of salts contains the larger proportion of metal, causes some confusion when they are applied without any such meaning. For example, "calcic sulphate" corresponds in constitution to "ferrous" and not to "ferric sulphate." I would rarely attempt to indicate the formula completely by numerals introduced into the name, but would give as a rule the simple name of "chloride" or "oxide" to that compound which is normal according to the atomicity of the particular metal. Thus I prefer "sodium dioxide" to "disodium dioxide" for Na_2O_2 . In a few cases it may be convenient to express more; thus the magnetic oxide of iron might be named "terferrum tetroxide." For the parallel series of tin, mercury, and iron salts respectively, the convenient designations of "stannous," "stannic," &c. may be retained, while each pair would naturally be represented by the simple name of the metal. Thus we might speak of the two "iron sulphates," "ferrous sulphate" and "ferric sulphate." A complex salt such as microcosmic salt might be called "sodium, ammonium and hydrogen phosphate." It appears to me clearly better to have a descriptive name of this kind thus divided into several distinct words rather than to attempt to form such a single word as "hydro-sodio-ammonic phosphate." I will only add that names with a numeral appear to me generally better than such vague terms as "peroxide" and "suboxide," and that as far as possible Latin numerals should be joined to Latin words, and Greek numerals to Greek words.

* Proceedings of the Ashmolean Society, New Series, No. 1.

ON THE DEVELOPMENT OF IDEAS IN NATURAL PHILOSOPHY. *

By JUSTUS VON LIEBIG.

(Concluded from page 263.)

We observe the influence of wealth upon the mind of the productive class in those commercial states whose trade originates with industry; the sons of the mechanics and merchants abandon the occupation of their fathers, the source of their wealth; their aim becomes the acquisition, not of money, which they possess in abundance, but of honour and distinction,—they devote themselves to science, to the service of the government, of the army, or the church, and in this manner from the productive rises the intellectual class.

In Europe a manufacture does not go down to the third generation, and, in like manner, mercantile houses pass in the second generation into other hands; therein consists in a free state the renovation of the whole industrial population with each generation, and the perpetual revival of industry,—the industrial grown rich makes room to the man without means, who aspires, and who produces new inventions, and thus a circulation is established in the state, by which its power and wealth constantly increase.

In Greece these relations were shaped in a totally different manner; there, as everywhere, wealth created the intellectual class of society, whose subsistence must be secured by the productive class; but the latter did not renovate and recruit itself in Greece; the free man without means was obliged to emigrate, he might possibly invent a machine, but he could not invent slaves, and without slaves he was debarred from acquiring wealth by industry in his country; the way of trade remained open to the minority only.

As soon as the circulation which preserves industry ceased in the state, and the power of production in the population, upon which its progress depends, Greece had arrived at the limit of her civilisation and culture. The rich people did not produce any further inventions, and with the absence of new facts gained from nature, dried up the source of the ideas indispensable to the enlargement of the domain of the mind, *i.e.*, the culture. The trade in home productions must by degrees pass over into the trade in products of other countries; by this means the accumulated capital could still for a time be saved, but the sinews of life of the slave state withered, for centuries before its decline became visible by outward marks.

The civilisation of the Greeks travelled by the Roman Empire and by the Arabs, into all countries of Europe, and its continuous development became manifest throughout the middle ages in the increase of inventions. At the end of the 15th century we already meet with higher algebra and trigonometry, the decimal divisions in calculations, the improved almanac, and in the field of medicine a complete revolution prepared; we find admirable progress in mining and in the metallurgical processes, in dyeing, weaving, and tanning, in the art of making glass, in engineering and architecture, and especially in the sphere of chemistry, paper, the telescope, fire-arms, watches, knitting with knitting-needles, table-forks, horse-shoes, bells, fire-places, and chimneys, the arts of wood-cutting and copper engraving, wire-drawing machines, the manufacture of steel, plate-glass, tinning of mirrors by lead and tin amalgam; wind, saw, and crushing-mills were discovered, and corn-mills, and the loom were improved.

These inventions give an idea of the progress of civilisation in Western Europe, and with these and the

geographical discoveries all acquisitions in the realm of mind in the 15th century are closely connected; we find a flourishing trade which embraces the whole of Europe from Geneva, Pisa, and Venice, to the coast towns of the German Ocean and the Baltic, and which connects Europe with the East, Arabia and India, and as its foundation we find an extensive industry in the thriving Flemish, Italian, German, and English towns; we observe in these towns a free opulent citizenship rise in increasing ability, and out of the civic elements the intellectual class of society naturally rises in consequence of accumulated wealth. From here commences the development of Greek and Roman culture.

At first the faculties of the newly originated learned profession were expended in endeavours to take possession of the inheritance of the intellectual treasures bequeathed by antiquity, and as long as the scholars had to learn and were disciples themselves, and the Greek and Roman culture was not yet alive in them, *i.e.*, not capable of being further developed, so long they could not fulfil their avocations of becoming teachers of the people. They even turned away, and not without reason, from the people and their language, for the literature of their country scarcely offered anything worthy to attract and engage their mind filled with the models of antiquity.

The position and the occupations of the scholars of that time co-operated in excluding them from intercourse with the productive classes, and the literature of that period therefore does not give us any information as to the degree of civilisation and culture of the people; the knowledge circulating in the population and penetrating into their thoughts, and developing itself from the better acquaintance with the physical laws and in proportion to the sum total of their more correct ideas of things and their relation to each other, had not yet been collected in books, and was totally unknown to the scholars.

The approximation of the intellectual and productive class was scarcely retarded by the seclusion of the learned profession, because the trading and industrial population up to the 14th century were without the necessary medium in the but little accomplished language of books. In lieu of the scholars the master singers worked successfully in their schools of music for the development and diffusion of the language by voice and pen amongst the civil classes; hitherto the productive class was limited in the exchange and increase of their experience exclusively to personal intercourse by travelling, they were a wandering class of society; but with the acquisition of the language of books the facts and experience gained by them were collected and became diffusible, and writing and reading, hitherto unknown arts, were recognised by the population as highly necessary means to exchange and increase their knowledge,—at first in the towns whose industry was not compatible with a wandering population. In these towns the first public schools were founded; the ardent desire to spread the treasures of antiquity by schools was, with the learned class, just as strong as the longing for instruction with the productive class. Both circumstances combined increased the demand for books, and the difficulty to meet this demand by copyists called forth in the middle of the 15th century the invention of printing.

A century before it would have been without the slightest influence upon the development of the mind: from the time at which it took place dates a new era in the history of culture.

In looking over the literature at the end of the first century after the printing of the first book with moveable letters, one is filled with astonishment at the extent and importance of what was accomplished in natural science and medicine, and at the extraordinary mass of facts and experiences which the middle ages had acquired and handed down in astronomy, technics, engineering, in handicraft, and industry, and which were now collected

* A Lecture delivered at the Meeting of the Royal Academy of Science, at Munich.

by those intellectually educated scholars of the high schools, which stood nearest to the productive classes, the medical men. In the 16th century the medical men were the founders of the modern natural sciences. They were the media of the intellectual education of the people. But again a century and a half elapsed before the knowledge collected and acquired by them was sufficiently arranged—sufficiently extensive and complete to become effective as a means of instruction in the universities; until then the foreign language in which their knowledge was deposited, and which was familiar to all scholars of Europe, had the advantage, which cannot be too highly estimated, of combining for the solution of their high problems all men of all European countries who devoted their energy to the promotion of science. Without the Latin language in common, their fruit-bearing co-operation would have become impossible. Only towards the end of the eighteenth century, fell, with its exclusion from science and literature, the last barrier which had separated the intellectual class from the productive. Both spoke again, as in ancient Greece, the same language, and understood each other, for science, school, and poetry co-operated to spread an equally high degree of education in all classes.

With the extinction of slavery in the Old World, and the combination of all elements further to develop the human mind, advancements in civilisation and culture were initiated, which are without end, indestructible, and imperishable.

In natural philosophy a change has taken place in the course of its cultivation. For some time this science had been supplied with all facts from which it formed by mental labour the derived ideas, by metallurgists, engineers, apothecaries, the industrial class generally, and natural philosophers had reduced their inventions to ideas which the manufacturing class received back in the shape of explanations and turned to profitable account.

The antipathy of the practical class to theory died out. The artisan, manufacturer, agriculturalist, the medical man, consult, as formerly in Greece, the scientific theorists. A new impetus was given to science as soon as the scientific investigator—the teacher of medicine—had acquired the technical skill and dexterity of the practical class, and when, on the other hand, the productive class had adopted the laws and scientific principles laid down by the scholars. Thus the man of science has become an inventor, and is independent in the prosecution of his studies. The manufacturer, the agriculturalist, has become an independent investigator, an intellectually free man.

A picture full of life, of endless activity, wide in results, unfolds itself before our view into the future. The past now appears to us in a different light. We look back with indifference at the conflicts between mediæval scholastics and ecclesiastics upon natural philosophy; their opposition was based upon the incapacity of distinguishing at that time between a hypothesis and a fact. All the ecclesiastical and secular power united could not prevent the invention of the telescope and the compass, and the discovery of oxygen, and could not suppress their reaction upon the human mind. A book may be burned, but not a fact.

With the proof of the earth being a small planet revolving round the sun, the former conception of "Heaven," and with the explanation of fire, the conception of "heat" lost its significance; with the discovery of atmospheric pressure, the belief in witchcraft and sorcery lost its foundation, for with the "dread" of a vacuum, nature lost her "will," her love, her hatred. With these discoveries man began to feel his power and his position in the universe.

If Aristotle and Plato had risen alive from their graves and had become teachers in the scholastic institutions of the middle ages, they could not have furthered the

progress in science for want of increase in derived ideas. The logic of the scholastics and the intellectual gymnastics raised upon it, were only adapted to their times and those which succeeded them; their hostile position to natural philosophy had no influence upon its progress.

And if the whole church and state power had been in league with the natural sciences, still the latter would not have advanced a single step, and would not have developed itself either sooner or in a different manner.

If we were to calculate the influence upon our time and our position which Luther effected, in conjunction with the great discoveries in the field of nature, and also the influence which these discoveries would have had without Luther, we should arrive at a peculiar result. We now know that the human conceptions are organically developed according to certain laws of nature and of the human mind, and we see the tree of human knowledge planted by the Greeks grow in the soil of civilisation, and by our care of the soil we see it develop itself without interruption, and blossom in the sunshine of freedom, and bear fruit in proper time. We have learnt that by external force its branches may be bent but not broken, and that its delicate and numberless roots lie so deep and hidden as to withdraw their silent working altogether out of the reach of human will and pleasure.

The past history of nations informs us of the impotent endeavours of political and ecclesiastical powers to perpetuate the bodily and intellectual slavery of men. The history of the future will record the victories of liberty gained by men by inquiring into the essence of things and into truth—victories gained with weapons not stained with blood, and in a combat in which morality and religion will take part only as feeble allies.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, November 21.

WARREN DE LA RUE, Ph.D., F.R.S., President, in the Chair.

THE minutes of the previous ordinary meeting were read and confirmed, and the donations to the library announced.

THE PRESIDENT then read a letter of acknowledgment written by Mrs. Faraday in answer to the address of condolence which was forwarded to her agreeably to the resolution passed at the last meeting. The names of candidates proposed were—Mr. Alfred E. Fletcher, Inspector of Alkali Works, Johnston, near Prescott; and William Frank Smith, M.D. Lond., Lecturer at the Sheffield School of Medicine, Glossop Road, Sheffield. For the second time were read the names of Thomas Hall, B.A. Lond., Lecturer on Chemistry and Natural Philosophy at the City of London School; Charles Walter Maybury, Teacher of Chemistry, 90, King Street, Manchester; George Lunge, Ph.D. (Breslau), 10, Albert Terrace, South Shields; Facundo J. R. Carulla, Chemist to the Atlas Steel and Iron Works, 59, Gell Street, Sheffield; and Alexander Crum Brown, M.D., Lecturer on Chemistry, 4, Rillbank Terrace, Edinburgh. The name of Charles Meymott Tidy, M.B., of the Hollies, Cambridge Heath, Hackney, was read for the third time.

The PRESIDENT gave notice that the next meeting of the Society, December 5, would be made general for the purpose of considering and taking action upon the proposal to alter the first by-law relating to the election of Fellows. The law at present stands thus:—

"Every candidate for admission into the Society shall be proposed according to a form of recommendation (No. 1, appendix) subscribed by three Fellows of the Society, to one, at least, of whom he should be personally known, and such certificate shall be read and suspended in the Society's rooms, or place of meeting, for three ordinary meetings."

It was now proposed to require the names of five members (instead of three) subscribed on the form of recommendation, to three of whom (instead of one) the candidate should be personally known. With respect also to the printed form of recommendation, it was suggested to modify the phraseology to "name;" and (in second line) "qualification or occupation, if any."

Mr. E. T. CHAPMAN made a statement on "*The Relation between the Results of Water Analysis and the Sanitary Value of the Water.*" Much has been said and written upon the proper method of performing water analysis, but comparatively little attention has hitherto been given to the interpretation of the results, and thus it happens after determining the ammonia, nitrates, phosphates, &c., the reporter usually appends to his analysis an opinion stated somewhat as follows:—"This water is perfectly harmless;" or, on the other hand, "exceedingly deleterious." The speaker's object was to fix a standard according to which the chemical quality of any given sample of water was to be judged. A good drinking water should not contain any appreciable amount of ammonia; lime salts communicate "hardness," but are not directly injurious to health; water containing nitrates in solution, but otherwise pure, was also harmless; if, however, these several ingredients occurred together in a water, the conditions were favourable to the development and growth of the lower forms of vegetable life, and such water kept in a cistern quickly assumed purgative properties. Mr. Chapman has made experiments upon pigeons, and found that when the birds were supplied with water of the last named quality, they were purged almost to death, and when the water was changed to a pure sample, or such as contained any one of the above ingredients alone, they soon rallied. These results were confirmed by experiments on the human system, and the author argued the necessity of observing the relations between the several ingredients in a water before pronouncing upon its sanitary value. The extended use of Clark's process was recommended as a means of removing the most objectionable forms of organic matter contained in waters holding in solution the carbonate of lime. A small proportion of impure water, such as that drawn from certain pumps in the City of London, was sufficient to start the decomposition and render unwholesome large bulks of Artesian water with which it was mixed. The quality of the water raised from the well in the Bank of England was such that, after storage in tanks, the colour became quite green, and the vegetable conservæ accumulated to such an extent as to choke the delivery pipes. Considerable amounts, both of ammonia and nitrate, existed in this water.

The PRESIDENT referred to the well water in Golden Square, which bore so bad a character in times of cholera visitation, as an example of a perfectly clear water having a pleasant flavour without any sign of desmidia or other species of vegetable organisms. This water contained nitrates and carbonate of lime, but its deleterious character was supposed to be due to decomposable organic matters existing in solution.

Mr DUGALD CAMPBELL said there were a great many wells about London supplying water pleasant to the taste, and containing 30 or 40 grains to the gallon of nitrates and nitrites. When an outbreak of cholera occurred the wells were closed. In Lincoln's Inn Fields were two water mains, marked S and H (*i.e.*, soft and hard); the

first was New River Water, and the other possessed a degree of hardness amounting to 50 of Clark's scale, and contained a large quantity of nitrate. Instead, however, of its being purgative the use of the water had the opposite effect.

Dr. STEVENSON had occasion to examine a supply of water of which cholera patients had partaken. He could not find in it any infusoria or other kind of pseudo-vegetable matter, nor products of their decomposition. The general opinion of physicians was adverse to the introduction and use of a water containing but a very small proportion of carbonate of lime.

Mr. SPILLER referred to the treatment of Kent water by Dr. Clark's process as now conducted at the Herbert Hospital, Woolwich. The softened water was found to differ in a remarkable manner from the original supply by its not permitting the growth of vegetable organisms.

Mr. CAMPBELL observed similar results many years ago with the softened water formerly supplied by the Plumstead Company.

Mr. CHAPMAN said that Dr. Clark's process was still being carried out at Caterham, and that by its use fully six-sevenths of the nitrogenous organic matter present in a water might be removed by the precipitated carbonate of lime.

Professor ABEL considered that the germinal inactivity and flat taste of the lime-softened waters were simply due to the removal of free carbonic acid. Organic matter was no doubt partially precipitated together with the carbonate of lime as a kind of lake, but that portion which remained in solution would eventually make its existence manifest when a re-absorption of carbonic acid from the air should have occurred.

The PRESIDENT in moving a vote of thanks, took occasion to refer to a successful instance of well-sinking by the American system, whereby he obtained a supply of good water at the rate of fifteen gallons per minute. This was accomplished by driving into the earth 1½ inch pipes shod with steel, which could be lowered twenty feet into hard gravel in the short space of three hours, a weight, or "monkey," of 70 lbs. being let fall upon the upper extremity of the tube.

Dr. J. H. GLADSTONE then read a paper "*On the Pyrophosphoric Amides.*"

The author stated that in former communications he had described three acid bodies that may be viewed as pyrophosphoric acid, in which one, two, or three molecules of amidogen have displaced an equal number of molecules of hydroxyl. Their composition and their relation to the original acid may be thus exhibited:

Pyrophosphoric acid	$P_2H_4O_7$
Pyrophosphamic acid	$P_2(NH_2)H_3O_6$
Pyrophosphodiamic acid	$P_2(NH_2)_2H_2O_5$
Pyrophosphotriamic acid	$P_2(NH_2)_3HO_4$

Since these papers were written he has come across some additional facts, and has formed a more precise conception of the rational formulæ of these bodies.

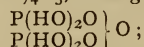
Pyrophosphamic Acid.—This acid had hitherto been formed only by the breaking down of the higher amide, but the author gave reasons for believing that it might be prepared synthetically. When the pyrophosphate of an earth or metal is prepared in the presence of ammoniacal salts, the precipitate when heated *per se* gives off ammonia and a peculiar sublimate, which is supposed to be characteristic of a pyrophosphamate. The ferric salt, however, differs from the ordinary ferric amate in being more soluble, and in being easily broken up by acids, and it was never obtained pure for analysis.

Pyrophosphodiamic Acid.—The author had previously published a characteristic test for this acid, founded on the fact that when a solution containing it is rendered strongly acid, and is heated with a few drops of a ferric salt, the flocculent white pyrophosphamate makes its appearance. But a chemist inexperienced in these compounds might easily be misled by the formation of the

insoluble ferric pyrophosphate, especially if the solution is not very acid. Hence it will be generally desirable, if not necessary, to dry a portion of the precipitate, and examine which compound it is by heating it *per se* in a test-tube, when the pyrophosphate simply fuses, and the pyrophosphamate does not fuse, but turns black at first, and gives off ammonia and a little white volatile salt. Still, as the proof that this acid may be prepared by the eleven methods noted in his paper, rests mainly on the evidence of this test, the author thought it well to repeat the principal experiments, examining whether it was the amate that was really produced. He has found it to be so in all cases; and has no reason to doubt that in each instance it had been formed by the decomposition of pyrophosphodiamic acid.

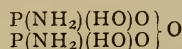
Pyrophosphotriamic acid.—The method formerly given for preparing this body was not a productive one, and the acid was apt to be contaminated with another compound, unless great attention was paid to the temperature. The following is a far more productive and a better process:—Saturate oxychloride of phosphorus with dry ammonia gas, without regard to the rise of temperature, heat the resulting mass at about 200° C., add water to it, and boil for about a minute. This will convert the whole of the insoluble portion into triamic acid, with very little loss from the production of other phosphoric compounds. This acid has also been met with among the products of decomposition of one of the tetraphosphoric amides that remain to be described at some future time.

Theoretical Constitution.—In his last communication the author suggested as the rational formula of pyrophosphoric acid, $P_2(HO)_4O_3$, or at greater length,

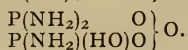


and he expressed his conviction that when this acid is produced by the mutual action of water and oxychloride of phosphorus, the two atoms of hydrogen in the molecule of water are attached simultaneously by two molecules of the chloride, and the water type is preserved in the new phosphorus compound.

The same principle was applied to explain the reactions by which these pyrophosphoric amides are formed, especially the symmetrical pyro-diamic acid; its rational formula will be



The unsymmetrical pyro-amic and pyro-triamic acids will be respectively,



A vote of thanks having been passed to Dr Gladstone, the President adjourned the meeting until Thursday, December 5th, when Mr. W. H. Perkin would read a paper "*On the Artificial Production of Coumarine and its Homologues.*"

The following report has been forwarded to every member of the Chemical Society:—

SIR,—At a meeting of the Council, held on May 16th, 1867, it was resolved, "That a Committee of five be appointed to consider the by-laws relating to the election of Fellows, Honorary Members, and Associates, and to report to the Council." It was further resolved, "That the Committee consist of Mr. Crookes, Dr. Miller, Dr. Odling, Mr. Wanklyn, and Dr. Williamson."

Upon the presentation of the Committee's report, at a meeting of the Council, held on November 7th, it was resolved, "That this report be approved, and that a copy of it be sent to each Fellow of the Society."

We beg to append the report in question, and have the honour to remain,

Your obedient servants,

W. ODLING,
A. VERNON HARCOURT,
Hon. Secretaries.

"Your Committee were appointed by a resolution, passed at a Meeting of Council, held on May 16th, 1867, in fulfilment of the intention which the Council announced to the Society in its anniversary report.

"As bearing upon the standard of qualification for admission to the Fellowship of the Chemical Society, your Committee, from replies they have received to a circular which they addressed to all the Fellows, and from conversations they have held with different Fellows whom they chanced to encounter, have ascertained the existence among the Fellows of the Society of two very distinct views as to its nature and purposes.

Many Fellows appear to regard the Society as being by rights an association of eminent scientific men; and they accordingly look upon the Fellowship of the Society as a distinction which should be conferred only upon those who have given evidence of marked chemical proficiency, as for example, by the production of some original memoir; so that the election of any one as a Fellow of the Society should stamp him at once as being a well-trained chemist and competent investigator.

"In favour of this view, it is urged that the initials F.C.S., appended to the name of any gentleman, seem to imply that his attainments have won for him a public recognition somewhat in the character of a degree; and that these initials ought to signify, in reality, that which they seem to imply, and which is indeed their proper signification.

"It is further urged that the Fellowship of the Chemical Society is essentially an honorary distinction, although from the ease with which it can be obtained, practically by any who choose, it is a distinction but little valued by the better sort. It is, however, eagerly sought after and obtained by men who are not perhaps altogether desirable—who certainly have no claim to the title of scientific chemists—and who, in some cases, do not even join the Society from any interest they take in chemical science, but solely with the view of parading a distinction to which their merits do not really entitle them.

"Moreover, from the circumstance that chemistry is pursued, not only as a science but also as a profession and trade, the right to append the initials F. C. S. possesses a sort of trade value, exceeding its cost, to mere trading or professional chemists; as suggesting that those who have the privilege of using these initials are better qualified men than their brethren who are not thus distinguished.

"From these causes, it is said, the Fellowship of the Chemical Society has gradually sunk in public estimation; and accordingly it is very desirable that something should now be done to restore, if possible, its original prestige.

"On the other hand, many Fellows are of opinion that the Society is merely an association of individuals, having joint but various interests in the progress of both pure and applied chemistry; that the object for which the Society exists is not to confer honour upon any individual whatever, but to promote the general advancement, distribution, and application of chemical knowledge; and that, as a general rule, men engaged in pursuits more or less dependent on or connected with chemistry, and taking a sufficient interest in chemistry to wish to join the Society should, unless personally objectionable, have every facility afforded them for joining it.

"In favour of this view, the preamble to the charter is adduced, and especially the following paragraph; whereas certain of our subjects 'did establish and are now members of a society known by the name of the Chemical Society, for the general advancement of chemical science, as intimately connected with the prosperity of the manufac-

tures of the United Kingdom . . . , and for a more extended and economical application of the industrial resources and sanitary condition of the community," etc.

"It is further maintained that the Society, from its origin until the present time, has always been of a mixed rather than of an exclusively scientific character—that the present Fellows form quite as distinguished a body as have ever constituted the Society—and that many, at any rate, of the most distinguished individual Fellows do not feel themselves at all discredited by being associated as joint Fellows of the Society with men who are engaged or interested in chemical pursuits, but whose scientific or social position is inferior to their own.

"Moreover, of scientific as distinguished from purely professional societies, the Royal Society, it is urged, is the only one of which the Fellowship is conferred in recognition of eminent scientific merit—the special science societies being practically open to all students of and workers at their respective subjects, who may wish to be elected to their respective Fellowships. To limit the Chemical Society then to eminent scientific chemists would be tantamount to making it the chemical section of the Royal Society, instead of allowing it to have a distinct function and character of its own.

"It is further urged that the circumstance of chemistry being to some extent a profession, so far from indicating the propriety of the Fellowship of the Chemical Society an honorary distinction, rather contra-indicates it. For, independently of the difficulty, or rather impossibility, of withholding or conferring the honour without doing much injustice to individuals, the Society, by professing to choose out the most worthy, would naturally be held responsible for its choice, and identified more or less with the acts of each and all of its Fellows.

"Your Committee having given these different views their best consideration, are not prepared to recommend any alteration in the bye-law relating to the election of Fellows, which would have the effect of confining the Fellowship of the Society to strictly scientific men.

"But they think it may be advisable, although they have failed to elicit evidence of the admission of any significant proportion of unsuitable persons into the Society, to make some modification in the present bye-law, with a view to increase the security against the accidental election of undesirable candidates.

"They accordingly suggest that in future, or after a certain interval of time, the form of recommendation of a candidate, referred to in the first paragraph of the bye-law in question, shall be required to be signed by five instead of by only three Fellows of the Society, of whom three at least instead of only one shall be required to sign from personal knowledge; and further, that in the second line of the printed form of recommendation, the words 'Qualification or Occupation' shall be substituted for the words 'Position, Profession, or Occupation.'

"At present your Committee are not disposed to advise any alteration in the second paragraph of the bye-law, which requires three-fourths of the votes given to be in favour of the candidate, in order to effect his election. If, however, contrary to the anticipations of the Committee, any section of the Fellows should be found to make an improper use of this requirement, your committee would then recommend that one or other of two courses should be proposed by the Council and adopted by the Society; that is to say, that the bye-law should be so altered as to render valid the election by a mere majority, or else that the bye-law should be temporarily abrogated, and during its abrogation the election of Fellows be delegated by the Society at large to a Committee appointed for the purpose."

THE INSTITUTION OF CIVIL ENGINEERS.

THE first meeting of the Session 1867-68 was occupied by the reading of a supplement to and the discussion upon the Paper "*Experiments on the Removal of Organic*

and Inorganic Substances in Water," by Mr. Edward Byrne, M. Inst. C.E., which was read at the close of last Session. The author now gave an account of experiments he had since made on the well-known filtering materials, magnetic carbide, and silicated carbon; and, after recording the results in a tabular form, he proceeded to make a comparison between those substances and animal charcoal.

His experiments were to the effect, that the action of the magnetic carbide was exceedingly feeble as regarded the removal of organic and inorganic impurities, and that it did not possess the property of softening the water except to a very small extent; whereas this property was possessed in a high degree by the two other filtering materials. Silicated carbon, however, quickly lost this power, and, after a short time, it rendered the water positively harder than it was before filtration. Animal charcoal, in its softening property, was not only more powerful than the silicated carbon, but more permanent in its action; and so far as the experiments went, it continued to remove inorganic matter. After a short time, however, it commenced to give back a portion of the organic impurity which it had previously removed. The silicated carbon, too, was found, in an equally short time, to give back not only the organic, but also the inorganic matter which it had previously taken up.

To decide whether the organic matter contained in the water, so far as the nitrogen was concerned, had undergone any oxidation by its passage through these substances, the amount of nitrogen in the original water, and in that passed through each filter, was determined by the process which Professor Wanklyn had recently made known. By this extremely delicate test it was found that, for equal quantities of organic impurity, the amount of albuminous matter in the original and in the filtered waters was precisely the same; which fact was considered a sufficiently clear proof that the organic matter contained in the water had undergone no change by its percolation through these filtering materials.

The author then expressed the opinion, that while filtration must ever be considered most valuable for the removal of matter in mechanical suspension, it was practically useless as a means of removing substances in solution. He argued that the deductions to be drawn from these experiments, though made on a small scale, would, by reason of the systematic manner in which they were conducted, be safely applicable to cases of far greater magnitude. He concluded by expressing a hope, that the result of these investigations would serve the purpose of pointing out the danger of depending too much on the system generally of filtration, as well as of exposing the inconsistency of bringing home foul water, to undergo a delusive method of purification; instead of adopting the proper and only satisfactory plan of procuring water which was itself naturally pure.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

Ordinary Meeting, November 12th, 1867.

EDWARD SCHUNCK, Ph.D., F.R.S., &c., President, in the Chair.

Mr. John Barrow was elected an Ordinary Member of the Society.

Mr. BINNEY, F.R.S., F.G.S., said that in the Rev. J. G. Cumming's excellent "*History of the Isle of Man*" that author, at page 132, says, "the different layers of the Posidonian schist vary both in their lithological texture and organic contents. The finest and most compact layer

which is worked for ornamental purposes, is characterised by an abundance of *Posidonia* and the reliëfs of tree ferns, which we must necessarily regard with interest as indicating an approach, though still at a considerable distance, from the coal formation of Great Britain." As the discovery of fossil tree ferns in the mountain limestone would be of great interest, he had lately been over to Poolvash Bay, the locality named by Mr. Cumming, and spent a considerable time in searching the black limestones there for those fossils; but although he met with plants, the remains of vegetables common to the carboniferous formation, such as *Stigmara ficioides*, *Calamites*, and other coal plants, he found nothing resembling tree ferns. The state in which the roots (*Stigmara*) were found in this limestone led him to believe that Mr. Cumming had mistaken them for tree ferns. The depressed areolæ in this fossil have the lower portion of the radicle attached to them so as to give the appearance of a scar not much unlike that of a tree fern, but he convinced himself that they were unquestionably *Stigmara*. This portion of *Sigillaria* is often met with in the beds of limestone in the Yordale series of Professor Phillips, as well as much lower down in the carboniferous series in the limestone of West Calder, near Bathgate, Scotland, where it occurs in great abundance. He also stated that the lower coal seams of Scotland containing workable beds were of considerably earlier date than the Posidonian schists of the Isle of Man.

Dr. R. ANGUS SMITH, F.R.S., said that he had frequently visited some parts of the Continent, and had been a student of exhibitions such as included the useful arts. He was quite prepared to agree with those who saw a very great improvement in the touch of the workman, in the countries nearest to us, in the north of Europe especially. In France the advance made was very great, and so also in Germany; but in neither of these cases did he consider that the exhibition showed the true state of the arts among the people. A true exhibition would give the proportion of bad and of good manufactures. There was no attempt to do this except in cases where the objects were viewed rather as curiosities, as for example, when costumes and architecture were introduced. When a number of knife makers showed their manufactures, it was clear that they all showed their best, but they did not show how many made knives that would scarcely cut, and even if they had done so, it would not have been sufficient to exhibit the state of the arts among the people. It would not inform us how many of the population had no knives set down to them at dinner, and how many houses had not a fork of any kind. In one of the countries which had made greatest progress and showed beautiful work of all kinds at the Exhibition, he had been in an hotel where no fork whatever existed, and when he asked for a knife, the landlady handed him one from her pocket. Yet she and the landlord were very respectable looking people, and the house was clean. True, it was only in a village, but it was only a few miles from a considerable town. The people were not the poorest, but probably the richest in the village. He had not found any similar case in Great Britain. These were decent people of the working classes in want of what we may consider the ordinary tools requisite in modern civilisation only three years ago. He did not wish to speak of any manufacture for the study of which he may have had special opportunity, but, speaking generally, he did not think that the modern changes had penetrated all classes of the community so deeply in France and Germany as the Exhibition represented, whereas England had done more than it showed at the Paris Exhibition. This is quite independent of the question which is best, and relates only to the useful arts.

It is clear, however, that wonderful advances have been made, and who makes them? He considered that they were made by the upper classes of the manufacturers, and used by the upper and middle classes, but had not descended universally even to the middle classes. When the general descent takes place, the manufacturers will have a much larger home market than they have at

present. It is for the interest of England that this advance among the people should take place, as in some instances it will prevent competition in foreign markets; but whatever the commercial result may be, there is one lesson which we may all learn. Within the last thirty or forty years, the violent attempts to teach the people here by schools, mechanics' institutes, and lectures given or promoted by benevolent persons attaching themselves to various societies, have wearied the souls of all who have co-operated or even looked on with interest. In Germany, without any commotion, calmly and pleasantly, the youths have been trained in schools and colleges without number, and so thoroughly that they are able to supply foremen and managers to their own manufacturing establishments, and to send a supply also to foreign countries, without diminishing the supply of that higher order of men of learning that have so long made Germany famous. In other words, whilst we have failed after the most violent efforts and much noise to teach our own, they have succeeded not only to teach their own citizens, but to assist in educating the rest of the world. In this matter of education, the governments have been able to mould the nation's mind, and to alter the habits of a leading portion of it in a very few years. A careful education would probably show its influence in less than ten years. True, many questions arise; and we may ask if education would not smooth down the peculiarities of the national character, and prevent it trusting to individual will and genius. Pedantic education might do this, but training is certainly as requisite in civil as in military affairs, and no one says that discipline diminishes the power of an army. It may be a question whether the uniform organisation of education in France is not calculated to produce too much equality in the minds of the nation, but it will certainly produce immense power in the aggregate. The numerous small states of Germany, each fostering its own schools and universities, seem best fitted to produce an intellectual activity. We see there, many universities, each developing its own peculiarities. They must make the nation more many-sided, and they have done so.' At any rate, the present lesson seemed to be that the more intelligent part of a nation may be fashioned anew in a few years by its instructors as easily as a boy may be taught to be either a shoemaker or a tailor; cases of original bent excepted. We desire schools in this country, but cannot find them; there is no organisation for making them to the extent they are required. The genius of this nation, great as it really is, impatient of details, and looking vigorously to results, will never compete in a wild state with the disciplined army of thinkers and of manufacturers abroad. Those who do succeed here must train themselves, and to that training they owe their success, but it is hard work, and not to be expected of many. However, it is clear that an entirely new spirit may be made to animate society in the course of a single generation, and a nation may be born in our own day; also, as the result has been, so far as the useful arts are concerned, exactly that which the rulers desired, we must believe that governments or large combinations of men have the change in their power.

It was said that this progress in the arts did not necessarily go down to the whole of society. There may be several reasons for this: the upper classes may be far advanced and the lower very poor, even when there is much good feeling. In some of the mining districts of Germany, sending out the most intelligent miners to distant parts for centuries, and teaching their own with great care in schools which have been imitated, but not surpassed, we find a population extremely poor. Nature has presented little to them. We cannot expect all farmers to be equally rich, when soils differ so much. In such cases, however, we can expect a careful superintendence and a thoughtful mode of husbanding resources, mitigating the evils of poverty, and producing content where otherwise abject misery would exist, and that we find.

The Exhibition shows how much may be done for the active minds of nations by a government fostering education, and the state of the same countries shows that intelligence, comfort, and wealth have been promoted also. Whilst the poorer parts alluded to, in Saxony for example, show that when from natural causes wealth has not been accumulated, education has produced intelligence to mitigate those evils which would otherwise have crushed the people. This education is owing to the activity of the governments. We learnt the lesson in this island once, and forgot it. We must be humble enough to learn it again from the world, instead of teaching it to them as we ought to have done.

The unassisted working classes in this country have raised themselves to an enjoyment of the products of civilisation not equalled probably anywhere in Europe, and their progress has been of longer duration; as we love our country we are still disposed to believe in its power of keeping in advance. But how could a regiment, however brave, advance with longbows against modern artillery?

We require education in the fundamental principles of physical science; the moral principles and teachings found in literature are not, when alone, sufficient either for the higher cultivation of every mind or the pursuit of the useful arts. This applies to the rich and not merely to the poor.

ACADEMY OF SCIENCES.

NOVEMBER 25, 1867.

(FROM OUR OWN CORRESPONDENT.)

Paralysis caused by Santonine—Safety in performing large Amputations—The "Just Susceptibility" of Marshal Vaillant.

M. EUGENE PELIKAN, director of the civil medical department of Russia, &c., presented a note on the local paralysis produced by saponine and analogous substances. He summed up the results of his experiments as follows: 1. Saponine and similar substances produce a local paralysis, followed by a rigidity of the muscles, and also paralysis of the nerves of sensation; 2. With regard to this local paralyzing action, there exists an analogy between saponine and substances acting upon the pupil, such as atropine, physostigmine, &c.; 3. Saponine, now employed in medicine, is probably destined to perform another part than that at present attributed to it, and for this reason it should be submitted to new clinical experiments; 3. That saponine does not cause either contractions of the muscles or of other parts to which it is applied, and that it annuls completely the irritability of the muscles (even rendering them rigid) submitted to its action, provided that the animal is in its normal state of health and is in possession of all its functions.

Dr. Maisonneuve, surgeon of the Hotel Dieu, read a paper on the continuous method of aspiration and on the advantages for the healing of great amputations. In a recent work presented to the Academy he explained that:—The numerous and febrile accidents which render complex the greater number of wounds, and which constitute the principal danger of surgical operations, are always the result of poisoning. The liquids exuding from the surface of the wound become morbid in contact with the external air, and poisonous putrefaction at once ensued, and the author came to the conclusion that the liquid at the surface of the wound could be hindered from putrifying and that great surgical operations, such as amputations, &c., could thus always be performed with safety to the life of the patient. The process recommended by Dr. Maisonneuve consists in submitting the stump of the limb amputated to a continuous aspiration, which draws off the liquids secreted by the wound according as they are formed, and to transport them to

a recipient before they have time to putrify. The following is the method employed: After having as usual stopped the flow of blood, by means of the ligature of the vessels, the wound is cleaned most carefully; it is washed with alcohol and dried with clean dry linen; the edges are gently united by means of bands of diactylon plaster, but without hindering the flow of the liquids; a layer of lint is then laid on, saturated with antiseptic liquids such as tincture of arnica, aromatic wine, or any other analogous substance, and the extremity of the limb is bound round with cloth soaked with the same liquid. After this preliminary dressing the process of the aspiratory apparatus is brought to play. The apparatus is composed of: 1. A sort of burette of caoutchouc furnished with a tube of the same substance. 2. A flask of three or four litres capacity; 3. An air pump which exhausts by means of a flexible tube.

Dr. Guerin read a memoir on the same subject, viz., Pneumatic Occlusion of Wounds, and he claims priority for his process. His apparatus consists of a very stout glass receiver with three tubular openings, one at the top and two lateral. That at the top leads to a dynamometer of very simple construction, a graduated glass tube terminated by an india-rubber ball filled with mercury. If the pressure diminishes, or a vacuum takes place in the balloon, the india-rubber bag dilates, and the level of the mercury lowers in the tube, thus giving the variations of the pressure. The inventor is convinced that by his method the expenses of hospital dressings and the dangers of operations will be much diminished. He has shown us his apparatus, which we have much admired, and he informs us that, at the Hotel Dieu, Dr. Maisonneuve had obtained wonderful results with his apparatus, which, after all, is only a modification of that of Dr. Guerin, to whom belongs exclusively the idea of the application of pneumatic occlusion to wounds, amputations, &c. We were eye-witnesses to the efficacy of Dr. Guerin's valuable instrument.

The Academy of Sciences has lost, for the time being, one of its most learned and honourable members, Marshal Vaillant, whose bland and noble countenance was one of the principal ornaments of the meetings. A just susceptibility has kept him at a distance, for more than six months, from his companions, for whom he was always ready to render a service, and to whom he was much attached. A favourable occasion has presented itself of bringing him again to the vacant chair which he had deserted. He has been named member of the commission charged with presenting a list of candidates to fill the place of free academician, vacant by the death of M. Civiale.

F. MOIGNO.

NOTICES OF BOOKS.

Companion to the New Edition of the British Pharmacopœia 1867. By PETER SQUIRE, F.L.S. London: John Churchill and Sons, New Burlington Street. 1867.

We are glad to find that Mr. Squire's Companion has reached a fifth edition. The reward is well deserved, and is accorded to few works of the kind; and this fact alone would suggest the void there would be in the literature of *Materia Medica* without it.

But a still more unprecedented fact is that this current edition has been reprinted within the short space of a fortnight, owing to the great demand. It was wise therefore, we think, to make no additions to the reprint, so as to avoid the formation of a new edition. However, if the sale of the work is sufficiently great, a new edition will, we hope, be prepared shortly, which will incorporate in it many new researches in Pharmacy, such as the use of carbolic acid externally in various solutions, the extended applications of the new remedies of the Pharmacopœia, and the detection of impurities in various

commercial specimens of drugs, for so many of which researches we are indebted to Mr. Daniel Hanbury, *e.g.*, Burgundy pitch and Storax. Mr. Squire will find his materials now increasing in a very rapid progression, and will yearly find the duty that he has undertaken a more difficult one. This perhaps may be sufficient to atone for some trifling matters which under other circumstances might serve for complaint.

Thus when a new and strikingly useful remedy is proposed, and the formula for the preparation of such is given, it is only fair to mention the authority introducing this, as a sort of guarantee.

A remedy proposed by Mr. A. may have its own value, but one proposed by Dr. B., whose name is a household word in the profession, may probably be thought more worthy of a trial.

In two succeeding paragraphs Mr. Squire gives a notice of urethral suppositories, or medicated bougies, followed by that of the medicated pledgets of cotton. The latter we are told were introduced by Dr. Greenhalgh, but who introduced the former? We should have thought that the name of Sir Henry Thompson, a court surgeon, would have been not only gracefully, but also authoritatively coupled with the mention of medicated bougies.

Again, under the head of Staphisagria we find only this, "The oil of the seeds, 1 to 7 of lard, has been successfully used by Mr. Balmanno Squire in *Prurigo senilis*." By the omission of the fact that an Unguentum Staphisagriae (made from the seeds) has been prepared in most of the hospitals of London for many years, it is implied that Mr. Balmanno Squire was the first to make known the vermicide properties of Staphisagria.

When in a work of authority, names of originators are given, it is impossible to exercise too much delicacy and tact.

All the chemical formulæ are given as in the Pharmacopœia of 1867, with the addition of the equivalents; we get as a result the following information: "Diluted phosphoric acid, $3\text{HO}, \text{PO}_5$, or H_3PO_4 , eqv. 98, dissolved in water . . . 6 fluid drachms contain half an equivalent PO_5 , or a quarter of an equivalent P_2O_5 ." The confusion here results from following too closely "official" authority.

The chief value of the work, viewed as a whole, lies in the amount of practical observation shown by its author, and the list of antidotes and incompatibles, always a very strong feature, has been in this edition strengthened still further. This information, so often neglected in textbooks of *Materia Medica*, is really indispensable, and Mr. Squire's book is the authority in this respect. The "Companion" may be fairly called the parent of the Pharmacopœia for the United Kingdom, but the honour of having for a younger offspring, a universal Pharmacopœia, or Codex, is we believe quite unattainable. The present edition, or perhaps the next, with a chemistry adapted to Continental views, we think deserves that honour as much as any work does. If any of our readers are about to purchase the British Pharmacopœia, we offer them the advice of *Punch* to those intending to marry,—"don't," buy "Squire's Companion" instead.

the form of albumenoid nitrogen, may perhaps be regarded degrees, or parts of a degree, referable to some arbitrary standard.

For such a standard, we may take for instance .1 mgrm. of ammonia per litre, and call that quantity 1° of nitrogenous matter. The amount I have chosen, viz. .1 mgrm. is perhaps not the one best adapted to the purpose; it is a quantity however, often found in the analysis of waters, and will serve for explanation.

I will give the results of three analyses lately made, and then apply the system I propose.

The specimens examined I have numbered 1, 2, and 3. 1000 c.c. was taken for No. 1, and half that quantity for Nos. 2 and 3. The examination was conducted in the manner described by the authors of the paper above referred to.

Water No. 1 is a specimen of that supplied by the Liverpool Corporation to the town in which I am staying. No. 2 was taken from a brook contaminated to some extent with sewage; No. 3 was from a stream receiving much sewage and refuse from bleach and other works.

I have, for the sake of comparison, examined waters from three totally different sources, waters in which the ratio of organic impurity was presumed to be progressive

No. I. 1,000 c.c.	No. II. 500 c.c.	No. III. 500 c.c.
By distillation with Na_2CO_3	By distillation with Na_2CO_3	By distillation with Na_2CO_3
1st 100 c.c.)	Mlgrm.	Mlgrm.
2nd . . .)	'0	'07
By alkaline permanganate	'15	'47
	'15	'54
		'75
		'84

In order to compare the above results it is necessary to double the amounts of ammonia found in Nos. 2 and 3, and we have—

No. 1	.. ..	'15
No. 2	.. ..	1°08
No. 3	.. ..	1°68

Translating these figures into degrees, and taking .1 mlgrm. of NH_3 per litre as the representative of a water of 1° of "organic nitrogen," we have for—

No. 1 a water of	1°5
No. 2 ..	10°8
No. 3 ..	16°8

It will be seen that I have not made any distinction between the degrees corresponding to the ammonia originally present as such, or due to the decomposition of urea, and those which represent the amount afterwards evolved on the addition of alkaline permanganate, but some distinction will probably be necessary.

I may remark, in conclusion that the result of the analysis of water No. 1 confirms Professor Wanklyn's statement in the *Laboratory* (No. 26, page 442), with reference to the stability of albuminoid matters in the presence of a boiling solution of sodic carbonate of the strength used by himself and colleagues in their process.—I am, &c.,

PHILIP HOLLAND.

Chorley, Lancashire.

CORRESPONDENCE.

ORGANIC MATTER IN WATER.

To the Editor of the Chemical News.

SIR,—Since the publication of Messrs. Wanklyn, Chapman, and Smith's paper, which has furnished a process, at the same time both qualitative and quantitative, for the estimation of organic matter existent in potable and other waters, the idea has suggested itself to me that the results obtained representing the amount of ammonia in millegrammes per litre, present as such, or in

SALT AS AN ADULTERANT IN THE DYEING TRADE.

To the Editor of the Chemical News.

SIR,—Amongst the substances fraudulently added to chemicals and drysalteries, both organic and inorganic, common salt holds a prominent place. When thus employed it not merely dilutes or lets down the article to which it is added, but often exerts a most injurious positive action. Thus when used to "spring," as it is called, extracts of dyewoods, it very much injures their quality. It is well known that to dye an even, fast, and brilliant shade the

colouring matter must be held in a state of perfect solution; or, if insoluble in the finest possible suspension, so that it may be slowly and gradually delivered to the fibre. Now the presence of salt impairs the balance between the solvent and the colour, and causes the latter to be rapidly and irregularly deposited on the surface of the goods in a dull state, capable of easy removal. In some cases the affinity of the fibre for the colour seems masked, so that the latter, instead of "taking on," falls as a sediment to the bottom of the dye-pan. At other times a colour or mordant previously put on is impoverished by the salt thus present. Thus to take a very common case—suppose a coburg or union damask has to be dyed green. The worsted having been dyed as usual, and the warp done a Prussian blue, the piece is passed through extract quercitron. If this has been adulterated with salt, the piece when apparently dyed will be found, after having been rinsed and dried, to have a green weft and a pale blue warp, the Prussian blue deposited on the cotton having been impoverished by the salt.

Ground turmeric is another article often mixed with salt, which imparts to it a brighter appearance in the state of powder. The action of the salt here is very similar to what has been above described. The mordants are, as the dyers term it, "naïged away" from the warps of the salt. Drysalts, when the salt in their turmeric is detected, have been known to state in extenuation that the article had been damaged by sea water, although men in their employment own that they are told to mix a certain proportion of salt with the root during grinding.—I am, &c.,
W.

MISCELLANEOUS.

Encouragement of Chemistry in France.—Dr. Quesneville writes in *Le Moniteur Scientifique*: "We have just heard two pieces of bad news. The first, which is irremedial, is the death of Millon, that distinguished chemist, whose career was cut short and health impaired by being sent to pass the best years of his life in Algeria, because his liberal opinions were too advanced to permit his remaining in Paris; The second is the arrest of our distinguished colleague M. A. Naquet, *Professeur Agrégé à la Faculté de Médecine*, which was doubtless owing to the same cause."

The Frescoes in Westminster Palace.—Mr. Ward has been recently engaged in the reparation of his pictures in fresco and water-glass, which fill panels in the Commons Corridor (these had, in more than one case, been affected by unknown and variously effective causes), and has succeeded to his satisfaction, so far as the experiment permitted. After cleaning the works with bread, they were coated with gelatine size, and the artist repaired the affected part with pure water-colour, which embodied with the size and formed distemper. The general appearance of the picture being thus restored, a coating of a new composition, consisting of benzole and paraffin, was applied to some of the parts which required additional fixing, and had the effect of deepening the colours and enriching the tones, as varnish upon oil-painting, without the shining surface. Except in one or two cases, this latter application was not made to the heads. This new mixture has been extensively employed on the pictures by Dyce in the Queen's Robing Room, which had suffered from the scaling off of portions of their surfaces, and, as we have witnessed, with remarkably good effect, that will be, we trust, permanent. The composition by Dyce, called "Courtesy," has been entirely covered thus. The large picture called "Hospitality" has not yet been so treated, and truly looks so brilliant and well in tone, that it will be superfluous to touch it. These pictures are pure frescoes; but the application may be made to distemper or size-painted

works, as with those of Mr. Ward. The fluid is warmed, and used at a temperature of about 70°, the surrounding atmosphere being heated to that degree. Mr. Wright, chemist of Kensington, devised, and, in conjunction with Mr. Cope, R.A., perfected the composition in question, which has been employed, with the sanction of Dr. Percy on the part of the Government, upon his own pictures at Westminster whenever they required it.—*Athenæum*.

Magnetic Carbide Filters.—In the *British Medical Journal* of last week the following paragraph appeared; "Our excellent contemporary, the *CHEMICAL NEWS*, seems to doubt, in their remarks upon this Report on the Purification of the Hooghly Water for the Supply of Calcutta, the value of the method of filtration by magnetic carbide. We can assure the *CHEMICAL NEWS* that experience and experimental investigation fully bear out the statements of Mr. Spencer. That 'so little has been heard of this process during the seven years in which the author says he has had practical experience with it,' perhaps Mr. Spencer or his friends can best explain. And it is, indeed, true that, considering its importance, it is little known; for 'if,' as our contemporary remarks, 'the purifying material possess the virtues accorded to it by the discoverer, it is especially our duty to protest against anything less than the universal application of the process in this country.' We regret that the purport of our remarks has been misunderstood, but at the same time we find no reason to qualify the opinions we expressed. Our objections took ground less against Mr. Spencer's *process*, than his *theories* explaining the action of magnetic carbide. Our talented contemporary is silent upon these, and would possibly hesitate, for instance, before allowing, with Mr. Spencer, that magnetic oxide of iron impregnated with carbon, in virtue of its magnetic nature, attracts into its pores the oxygen from atmospheric air, leaving the nitrogen behind. If Mr. Spencer can prove this it would be highly interesting, but at present evidence tends to an opposite conclusion, in fact the experiments of Faraday prove the contrary. Granting, for the sake of argument, that oxygen is attracted into the pores of magnetic carbide, what proof, or even probability is there of it being thereby converted into ozone? The extracts inserted in the article upon the water supply of Calcutta (*CHEM. NEWS*, p. 231) must we think, have shown our readers how much rested upon Mr. Spencer's *ipse dixit*, and how little upon experiment. It is not too much to say that if experiment bore out these statements they would possess extraordinary interest for the scientific world. With regard to the process itself we do not deny that magnetic carbide exerts a purifying action upon water, possibly greater than carbon. But as to its differing from carbon in the action not gradually declining after immersion in water, we can only say that experiments such as carry conviction to the minds of scientists are wanting, whilst the assertion is opposed to the existing opinions upon the subject.

CONTEMPORARY SCIENTIFIC PRESS.

(Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "*Chemical News*."

Journal für Praktische Chemie.

No. 14.

C. F. SCHONBEIN, "On the Presence of Ozone in the Atmosphere." FRITZSCHE, "On the Solid Hydrocarbons of Coal Tar." F. BELLSTEIN and U. KREUSLER, "On Para-Nitrotoluylic Acid and its Derivatives." C. F. BARFOED, "On the Isomerism of the Stannic Acids."

No. 15.

E. MULDER, "On Trisulphocarbonic Acid Acetoniun." F. GÖPPELRODER, "On a Fluorescent Substance Obtained from Cuba Wood." J. C. IJELSTROM, "On the Analysis of some Minerals from Wernland, in Sweden."

Bulletin de la Societe d'Encouragement.

June, 1867.

H. BOUILLET, "On the Production of Busts and Statues by the Electrotype Process.—On the Electro-deposition of Gold of various Colours." STOSS, "On the Use of Oxide of Chromium for Polishing Metals." BALARD, "On E. Carré's Improved Machine for the Manufacture of Ice by the Absorption of Aqueous Vapour by Sulphuric Acid in a Vacuum." DUMAS, "On the same Subject." THENARD, "On the Preservation of Milk by the Application of Cold, *à propos* of the same Subject." PELIGOT, "On the Flexibility of Glass." DE LUYNES, "On the Colouring Matters of Orcine, and on a Product derived therefrom analogous to Carthaminic Acid." ISAMBERT, "On two improved Magnesium Lamps." DUMAS, "On a Specimen of Anthracite or Black Diamond of remarkable hardness." BOUIS, "On De Milly's Improvements in the Manufacture of Fatty Acids." H. MONIER, "Improved Crystal Gas Burners." J. AGNELLET, "On the Foundation of a Prize for an improved constant Battery." DUMAS, "On the Manufacture of Tartaric Acid."

L'Invention.

August, 1867.

M. MILAN, "A Process for extracting Silver from Lead." RAVE, "On a new Aniline Black for the Manufacture of Printing Ink." SCHLUMBERGER, "On the Preparation and Use of a new Green Colouring Matter extracted from Toluidine. PIEDAUL, "On the Use of a Solution of Fatty Matters in a Hydrocarbon or in Bisulphide of Carbon for preserving and softening Leather." P. JAVAL, "On the Preparation and Use of certain Fatty Bodies." MALLET, "On the Production of Oxygen and Chlorine Gas, either together or separately, from Sub-chloride of Copper." SCHLUMBERGER, "On the Preparation of some Blue and Violet Colouring Matters from Rosotoluidine."

Dingler's Polytechnisches Journal.

August, 1867.

A. OTT, "On Lugo's Apparatus for Distilling Petroleum." H. W. ILGEN, "On the Use of Refuse Grape Skins for manufacturing Gas and Lamp Black." "On the Manufacture of Plastic Charcoal for Filters."

Kunst und Gewerbeblatt.

June, 1867.

R. WAGNER, "Report on the Chemical Products at the Paris Exhibition." E. DIETRICH, "On the Preparation of Indigo Carmine." R. WAGNER, "On the Detection of Paraffin in Samples of Wax by a Comparison of their relative Specific Gravities."

Journal des Fabricants de Papier.

July 15, 1867.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper-making. Continuation: Sulphate of Iron."

Revue Universelle des Mines.

March—June, 1867.

L. PERARD, "On the Conservation of Force." P. KUPFFER-SCHLAEGER, "On some Modifications of Margueritte's Process for the Volumetric Estimation of Iron." GRUNDMAN, "On the Decomposition of Coals when exposed to the Air."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3127. E. C. Prentice, Stowmarket, Suffolk, "Improvements in the treatment of gun-cotton and charges or cartridges made therefrom, as also in the processes employed in their manufacture."

3132. I. Baggs, High Holborn, Middlesex, "Improvements in preparing and oxidising certain substances capable of producing chlorine."—Petitions recorded November 6, 1867.

3168. E. B. Wilson, Bolton, Lancashire, "Improvements in furnaces."—November 9, 1867.

3194. J. C. Bayley, and D. Campbell, John Street, Adelphi, "Improvements in fire-lighters and fire revivers."

3198. W. H. Crispin, Marsh Gate Lane, Stratford, Essex, "Improvements in the manufacture of artificial fuel."—November 12, 1867.

NOTICES TO PROCEED.

1924. G. A. F. Fowlke, St. James' Street, Westminster, "Improvements in compositions for preventing the fouling of the bottoms of ships, floating docks, and other similar structures, and in the mode or means of applying the said compositions."—Petition recorded July 2, 1867.

2611. C. Holste, Henrietta Street, Covent Garden, Middlesex, "Improvements in blast furnaces."—A communication from F. Lurmann, Oeside, near Osnabruck, Prussia.—September 17, 1867.

3332. J. Young, Aspull, Lancashire, "Improvements in the application of canal coal 'slack' to the manufacture of gas and coke."—October 28, 1867.

2006. G. Gabillon, Rue Jaquet, Paris, "A process to prepare and preserve paper and tissues with a solution of perchloride of iron, intended for stopping the bleeding of wounds."—Petition recorded July 9, 1867.

2046. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in the manufacture of steel and soft iron from cast iron."—July 12, 1867.

2973. W. Brookes, Chancery Lane, "An improved method of treating hides in the process of tanning, and for apparatus employed therein."—A communication from M. M. J. Hallenstein and A. Cleg-horn, Footscray, Victoria.—October 22, 1867.

NOTES AND QUERIES.

Bleaching Palm Oil.—Referring to No. 414 of your valuable journal, I beg to acknowledge with grateful thanks to Mr. C. R. A. Wright his full and clear description of the method of bleaching palm oil by chromic acid. I have been greatly more successful since applying the proportion of the bleaching agents which he prescribes. I have also discovered the desirability of keeping the materials well up together while the bleaching is going on; and as he suggests a method of agitating superior to the employment of paddles, viz., "to blow air through the mass," I wish Mr. Wright to be good enough to inform me the description of apparatus necessary for this purpose, and also if the temperature of the air must be elevated to correspond with that the oil.—GEORGE JOHNSON.

Spontaneous Ignition of Charcoal.—I cannot agree with "Scrutator" that this phenomenon is certainly new, as I have met with several instances of it during the preparation of the "Granular Charcoal," recently noticed in your columns; lamp-black, after having been carefully washed and afterwards dried again, is very liable to ignite spontaneously, and on this very account is less used in pyrotechny than formerly. I have lately inspected some enormous stills used for the generation of sulphurous acid; the charcoal employed, if taken out for any purpose, is almost certain to undergo spontaneous combustion, sooner or later, unless quickly and carefully excluded from the air.—WENTWORTH L. SCOTT.

Spontaneous Ignition, or Combustion.—I beg to remind Mr. Holmes that a great many porous substances, e.g. finely divided metals, so readily absorb oxygen from air as to become visibly incandescent in daylight; not only powdered wood charcoal, but that article in bulk, equally so animal charcoal, and pitcoal, are not unfrequently known to have got ignited, the cause being due to the rapid absorption of oxygen from the air aided by the bad conducting power for heat these substances are endowed with. To the same category belong the phenomena of the spontaneous ignition of hay, straw, flax, and saw-dust in large heaps, also, and this is a frequent cause of fires, the extreme danger of cotton or linen rags, tow, and even some kinds of paper saturated with oil and grease. A few years ago a remarkable instance of spontaneous ignition took place in ships anchored in the roads of Batavia. On board these vessels among the cargo was a quantity of Turkey-red dyed cotton which, as is well known, is obtained by the use of oil as mordant. It was clearly made out by careful experiments made by a scientific committee appointed to inquire into the cause of these fires, which were at first taken to be due to malice, that actually the spontaneous ignition of the Turkey-red dyed cotton was the true cause of the fire. The spontaneous ignition of charcoal has often been fatal to gunpowder works, while equally, the spontaneous ignition of animal charcoal has caused fires in sugar refineries.—Dr. A. A.

MEETINGS FOR THE WEEK.

Saturday, November 30.

Royal Society—Anniversary Meeting, 4 p.m.

Monday, December 2.

Royal Institution—General Monthly Meeting, 2 p.m.; Medical, 8 p.m.

Wednesday, December 4.

Geological Society, 8 p.m. "On the Graptolites of the Skiddaw Series." By Dr. H. A. Nicholson, F.G.S. "On the Fossil Corals of the West Indies."—Part IV. By Dr. P. Martin Duncan, Sec. G.S. Pharmaceutical Society, 8 p.m.

Society of Arts, 8 p.m.

Thursday, December 5.

Royal Society, 8½ p.m.

Chemical Society, 8 p.m.—"On Artificial Formation of Coumaric Acid." By Mr. H. W. Perkin.

Friday, December 6.

Geologists' Association.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the CHEMICAL NEWS are Removed from Wine Office Court, Fleet Street, to

BOY COURT, LUDGATE HILL, E.C.

where all Communications are requested to be addressed.

H. Hallet.—The largest rough diamond on record was the "Great Mogul;" originally it weighed more than 6 ounces, but was reduced by cutting to two ounces. It is now lost.

Lux.—Manufactured on the large scale, oxygen would not be dear. It could be made for much less than 20s. per 1000 feet. The great objection to its introduction would be the necessity of having two sets of mains in all the thoroughfares.

Querist.—Must and musk are very different things: the former is the technical name given to the unfermented juice of the grape, the latter is an animal perfume. From the context it is evident that your correspondent has made a clerical error and refers to the former, not to musk.

THE CHEMICAL NEWS.

VOL. XVI., No. 418.

ON MONO-CARBON COMPOUNDS.*

By Dr. ODLING, F.R.S.

THE principal compounds of carbon with hydrogen, oxygen, and nitrogen, which contain only one atom of carbon in their respective molecules, are the following: The existence of methylen H_2C , is very doubtful.

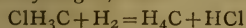
H_4C	Marsh-gas or methene.
H_4CO	Wood spirit or methyl alcohol
H_2CO	Formic Aldehyd.
H_2CO_2	Formic Acid.
H_2CO_3	Carbonic Acid.
	CO Carbonous oxide.
	CO_2 Carbanhydride.
HCN	Prussic or hydrocyanic acid.
$HCNO$	Cyanic acid.

Formic acid furnishes only one class of salts, which are consequently monobasic, as exemplified by sodium formiate $NaHCO_2$, for instance. Carbonic acid furnishes two classes of salts, acid and entire, or mono- and dibasic, as exemplified by the two sodium carbonates, $NaHCO_3$ and Na_2CO_3 , for instance. Carbonous oxide and carbanhydride gases may be regarded as dehydrated forms of the formic and carbonic acids respectively. Carbonic acid, indeed, H_2CO_3 , is not known as an isolated compound, but only in the state of aqueous or dissolved anhydride.

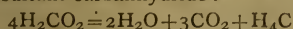
In addition to the above formulated mono-carbon compounds, various derivatives of them exist, in which the constituent oxygen of certain of them is represented by sulphur, and the constituent hydrogen by chlorine or a congener, as in chloroform Cl_3HC , methyl mercaptan H_4CS , phosgene Cl_2CO , sulphocyanic acid $HCNS$, &c.

All the above normal compounds are susceptible of mutual metamorphosis, especially through the intervention of their chloro- and sulpho-derivatives, but the two simple oxides are alone directly procurable from elementary carbon. The principal metamorphic relations of the several compounds are as follows.

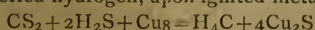
a. Methene, H_4C , is procurable from methyl alcohol H_4CO , indirectly, through the intervention of various methyl-compounds, such as methyl-iodide, mercury methide, &c., usually formed from the alcohol. The hydro-carbon and alcohol are more especially associated by means of methyl-chloride, which is both producible from and transformable into either one of them. Prepared from methyl-alcohol, for instance, it furnishes marsh-gas by the action of nascent hydrogen, thus:



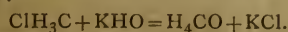
Methene is further procurable from formic acid H_2CO_2 , by its transmission over ignited baryta, which serves to absorb the resultant carbanhydride:



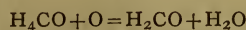
Also, from the sulpho-derivative of carbanhydride, namely disulphide of carbon CS_2 , by its reaction, conjointly with sulphuretted hydrogen, upon ignited metallic copper:



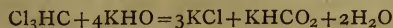
β. Methyl-alcohol H_4CO , is procurable from marsh gas H_4C , indirectly, by decomposing with potash its derivative methyl-chloride, a compound obtainable from marsh-gas, as already mentioned, by its gradual reaction with chlorine:



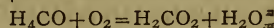
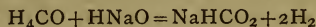
γ. Formic aldehyde H_2CO , a compound of very recent discovery, is obtainable by effecting the aerial oxidation of methyl alcohol vapour, by means of a coil of ignited platinum wire:



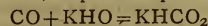
δ. Formic acid, H_2CO_2 , is procurable from marsh-gas H_4C , by decomposition of its derivative chloroform with potash:



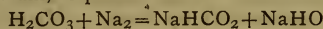
Also from methyl-alcohol H_4CO , by its reaction with heated soda-lime; and, with intermediate production of formic-aldehyd, by various oxidations of the alcohol, including its exposure to air under the influence of platinum black:



Also from carbonous oxide CO , by its combination with heated caustic potash, to produce potassium formiate:

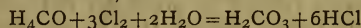


Also from carbonic acid H_2CO_3 , by its reduction with metallic sodium, to produce sodium formiate:

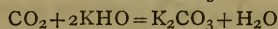
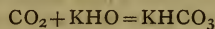


Carbonous oxide CO , is producible by the dehydration of formic acid H_2CO_2 , with oil of vitriol, for instance; and by the deoxidation of carbanhydride CO_2 , with ignited zinc, iron, carbon, &c.

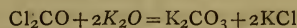
ε. Carbonic acid H_2CO_3 , is procurable from marsh-gas H_4C , methyl-alcohol H_4CO , and formic acid H_2CO_2 , by various oxidations, as with moist chlorine for instance:



Also from carbanhydride CO_2 , by its solution in water, or its fixation by caustic alkali, to form a mono- or dibasic carbonate:



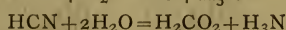
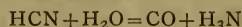
Also from carbonous oxide CO , indirectly, through the intervention of phosgene, by decomposition of this compound with water or alkali:



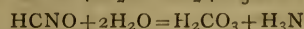
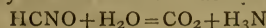
Carbanhydride CO_2 , is producible by the mere desiccation of carbonic acid H_2CO_3 ; and by the direct oxidation of carbonous oxide CO , as with air and spongy platinum for instance, or by different metallic oxides at a red-heat.

The formic and carbonic acids, with their anhydrides, have corresponding relations of metamorphosis to hydrocyanic acid and cyanic acid respectively.

Hydrocyanic acid HCN , when heated with oil of vitriol, absorbs one atom of water, with production of carbonous oxide and ammonia; and, when heated with potash, absorbs two atoms of water, with production of formic acid and ammonia:



Under similar treatment, cyanic acid $HCNO$, absorbs one and two atoms of water, with production of ammonia, and of carbanhydride and carbonic acid respectively:



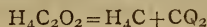
The ammonia, formed in the oil of vitriol reactions, appears of course as sulphate of ammonia, and the formic and carbonic acids, produced in the potash reactions, appear as potassium salts.

Independently of their origin from one another, and from cyanic compounds, as above described, the leading members of the methyl-formic families are obtainable from the following principal sources.

Methene occurs naturally as fire-damp, marsh-gas, &c., and forms an important constituent of ordinary coal-gas. It is usually made from acetic acid, the

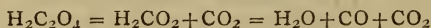
* Dr. Odling has kindly permitted us to publish occasional Chapters from Part II. of his "Manual of Chemistry," which we are glad to be able to announce is now in the press.—Ed. C.N.

vapour of which undergoes decomposition, at a red heat, into equal volumes of methene and carbanhydride :

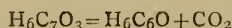


Methyl alcohol, or hydrate, which forms the chief constituent of commercial pyroligneous spirit or wood-naphtha, is also obtainable from the methyl salicate occurring in gaultheria oil, from the methyl acetate found together with the hydrate in crude wood-naphtha, and from the methyl-chloride or iodide produced by the action of hydrochloric or hydro-iodic acid upon narcotine.

Formic acid exists naturally in the juice of red ants, &c. It can be procured by heating starch and similar organic substances with different oxidising mixtures; but is usually made by the decomposition of oxalic acid, a compound also resorted to as a source of carbonous oxide :



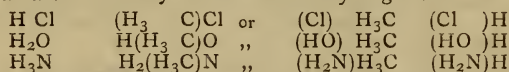
Carbonic acid or anhydride is readily procurable from its different salts, whether found native, or produced artificially by the combustion of organic matter, coal, &c., in actual or virtual presence of bases. It is also a very frequent product of the oxidation and decomposition of organic compounds. Many organic acids, for instance, as already exemplified by acetic acid, undergo, when heated either alone or with caustic alkali, a decomposition into carbanhydride and some other compound. In this way calbanic acid, for instance, yields carbanhydride and phenol :



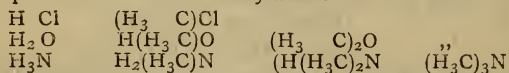
The primary compounds of carbon may be conveniently considered as forming three distinct groups, namely, the methylic, typified by marsh-gas H_4C ; the formic, typified by formic aldehyd H_2CO , or marsh-gas, in which two atoms of hydrogen are replaced by one atom of diad oxygen; and the cyanic typified by prussic acid HCN , or marsh-gas in which three atoms of hydrogen are replaced by one atom of triad nitrogen. The origin and relationship of the various cyanic compounds are discussed after the description of the individual methylic and formic compounds.

METHYLIC COMPOUNDS.

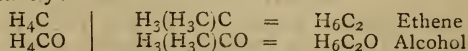
The relationship of methyl-alcohol, to methyl-chloride and methylamine respectively, corresponds exactly with that of water to hydrochloric acid and ammonia; and the three bodies may be regarded as derivatives of hydrochloric acid, water, and ammonia, by substitution of an atom of methyl for an atom of hydrogen :



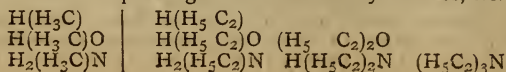
By a further substitution of methyl for the hydrogen of water, there is produced methyl-ether, as above referred to; while, by its further substitution in ammonia, there are produced di- and tri-methylamine.



By a similar substitution of methyl for the hydrogen of methyl itself, as existing in marsh-gas and methyl-alcohol, for instance, there are produced the homologues of marsh-gas and methyl alcohol, or ethene and common alcohol respectively :—



And just as marsh-gas and methyl-alcohol are regarded as the hydride and hydrate of methyl, so may ethene and ethyl-alcohol be regarded as the hydride and hydrate of ethyl, and so do they form an ether or oxide corresponding to methyl ether, and three successive amides or nitrides corresponding to the three methyl-amines, &c.



Moreover, various mixed or intermediate compounds are also known, such for instance as methyl-ethyl ether $(\text{H}_3\text{C})(\text{H}_5\text{C}_2)\text{O}$, methyl-diethylamine $(\text{H}_3\text{C})(\text{H}_5\text{C}_2)_2\text{N}$, &c. Thus the radicals methyl and ethyl, which, for brevity's sake, are often represented by the symbols "ME" and "ET," have the similar property of replacing hydrogen in a great variety of bodies, to form methyl and ethyl derivatives, corresponding closely to one another in constitution, formation, decomposition, and general behaviour; so that to almost every methyl compound there exists a corresponding ethyl compound; and indeed, from various causes, the ethyl series of compounds has been altogether better studied, and is more complete, than even the methyl series itself. In addition, however, to analogues of the different methyl compounds, the ethyl series, by reason of the greater complexity of its primary hydrocarbon, includes various compounds which have not, and cannot have, true methyl analogues.

By a further substitution of methyl in methyl-methyl or ethene, $\text{H}_3\text{C.H}_3\text{C}$ or H_6C_2 , there is produced a new hydrocarbon propene $\text{H}_3\text{C.H}_2\text{C.H}_3\text{C}$ or H_8C_3 , which may also be represented as propyl-hydride $\text{H}(\text{H}_7\text{C}_3)$, and of which propyl alcohol, $\text{H}_8\text{C}_3\text{O}$ or $\text{H}(\text{H}_7\text{C}_3)\text{O}$ is the corresponding hydrate; and so on indefinitely. The earlier terms of this homologous series of hydrocarbons and alcohols, and of the acids resulting from the oxidation of the alcohols, are given in the following table :

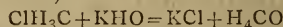
Hydrocarbon.	Alcohol.	Acid.
H_2 Hydrogen	$\text{H}_2 \text{ O}$ Water	
$\text{H}_4 \text{ C}$ Marsh-gas	$\text{H}_4 \text{ C O}$ Methyl	$\text{H}_2 \text{ C O}_2$ Formic
$\text{H}_6 \text{ C}_2$ Ethene	$\text{H}_6 \text{ C}_2 \text{O}$ Ethyl	$\text{H}_4 \text{ C}_2\text{O}_2$ Acetic
$\text{H}_8 \text{ C}_3$ Propene	$\text{H}_8 \text{ C}_3 \text{O}$ Propyl	$\text{H}_6 \text{ C}_3\text{O}_2$ Propionic
$\text{H}_{10} \text{ C}_4$ Butene	$\text{H}_{10} \text{ C}_4 \text{O}$ Butyl	$\text{H}_8 \text{ C}_4\text{O}_2$ Butyric
$\text{H}_{12} \text{ C}_5$ Eupione	$\text{H}_{12} \text{ C}_5 \text{O}$ Amyl	$\text{H}_{10} \text{ C}_5\text{O}_2$ Valeric
$\text{H}_{14} \text{ C}_6$ Caprene	$\text{H}_{14} \text{ C}_6 \text{O}$ Capryl	$\text{H}_{12} \text{ C}_6\text{O}_2$ Caproic

Methene has some similarity, and at the same time considerable dissimilarity, to another hydrocarbon known as phenene, or hydride of phenyl H_6C_6 ; and just as ethene is produced by the replacement of hydrogen by methyl in methene, so is benzoene or toluol produced by the same replacement of methyl for hydrogen in phenene. The resulting methyl-methene or ethene, and methyl-phenene or benzoene, correspond closely with one another, and give rise to strictly analogous compounds and series, thus :—

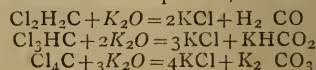
Hydrocarbon.	Alcohol.	Acid.
$\text{H}_6 \text{ C}_2$ Ethene	$\text{H}_6 \text{ C}_2 \text{O}$ Ethyl	$\text{H}_4 \text{ C}_2\text{O}_2$ Acetic
$\text{H}_8 \text{ C}_7$ Benzoene	$\text{H}_8 \text{ C}_7 \text{O}$ Benzyl	$\text{H}_6 \text{ C}_7\text{O}_2$ Benzoic
$\text{H}_{10} \text{ C}_8$ Xylene	$\text{H}_{10} \text{ C}_8 \text{O}$ Xylyl	$\text{H}_8 \text{ C}_8\text{O}_2$ Toluic
&c.	&c.	&c.

METHYL-HALIDES, ETC.

As previously mentioned, methyl chloride ClH_3C , is procurable from marsh-gas H_4C , by direct substitution of chlorine for hydrogen, and from methyl alcohol, H_4CO or $(\text{HO})\text{H}_3\text{C}$, by substitution of chlorine for hydroxyl. It also occurs as a product of the decomposition by heat of the hydrochloride of kakodylic acid $\text{H}(\text{H}_3\text{C})_2\text{AsO}_2\cdot\text{HCl}$, and of the reaction of hydrochloric acid with narcotine. It is decomposable by potash, with reproduction of methyl-alcohol (Berthelot) :

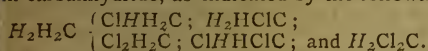


By the further action of chlorine upon methyl-chloride, there are produced, in succession, the higher derivatives $\text{Cl}_2\text{H}_2\text{C}$, Cl_3HC , and Cl_4C ; but the decomposition of these compounds by caustic potash leads to the production, not of methylic, but of formic compounds, thus :



The first of these reactions has not been established, owing probably to its incomplete examination. By treatment with nascent hydrogen, perchloride of carbon Cl_4C , is successively reconverted into chloroform Cl_3HC , this into methylen-chloride $\text{Cl}_2\text{H}_2\text{C}$, this into methyl-chloride

CH_3C , and this last, as already stated, into marsh-gas H_4C . Some halogen derivatives of marsh-gas appear, but are not altogether proved, to exist in two or more isomeric forms. The existence of two chlorides of methyl, and of three chlorides of methylene, is easily conceivable on the assumption that one pair of hydrogen atoms in marsh-gas represents the oxygen of carbonous oxide, while the other pair represents the more loosely combined excess of oxygen in carbanhydride, as indicated by the following formulæ:



CONTRIBUTIONS TO THE HISTORY OF METHYLIC ALDEHYDE.*

By A. W. HOFMANN, LL.D., F.R.S.

"The aldehyde of the methyl-series is not known;" all the chemical manuals say so, and for the last twenty years my students have been duly informed thereof. It will scarcely appear strange that more efforts to become acquainted with that body should not have been made, since the masterly picture which Liebig has delineated of the aldehyde *par excellence* embraced as it were the history of the whole class, and of course also of the aldehyde in question. Nevertheless methylic aldehyde deserves our consideration for more than one reason. As one of the simplest terms of the monocarbon-series, occupying a position intermediate between marsh-gas and carbonic acid, as a link of transition connecting methylic alcohol and formic acid, as either aldehyde or acetone, according to the point of view from which we look upon it, the compound CH_2O illustrates a greater variety of relations than any one of the higher aldehydes. But in addition to the interest with which the methyl-compound has thus always been invested, this substance possesses special claims upon our attention at the present moment. Our actual method of treating organic chemistry for the purposes of instruction almost involves the necessity of starting from the methyl-series. The simplest of aldehydes thus acquires quite an especial importance, and all those who, like the author of this note, are engaged in teaching, cannot fail to have sadly missed a compound which is the carrier of such varied and interesting considerations.

The desire which I have frequently felt in my lectures of developing the idea of the genus aldehyde, when speaking of the methyl-compounds, has more than once induced me to attempt the preparation of methyl-aldehyde, but it was only at the conclusion of my last summer course that I succeeded, to a certain extent at all events, in attaining the object of my wishes.

A substance possessing the composition and the properties of methylic aldehyde is formed with surprising facility if a current of atmospheric air, charged with the vapour of methylic alcohol, be directed upon an incandescent platinum spiral.

The bottom of a strong three-necked bottle, of two litres' capacity, is covered to the height of about five centimetres with moderately warm methylic alcohol. The first neck is provided with a tube descending to the very surface of the liquid; into the second is fixed a loosely-fitting cork, which carries the platinum spiral; the third one, lastly, communicates with the upper end of a condenser, the lower end of which is fastened into a two-necked receiver. This receiver is in its turn connected with a series of wash-bottles, and the last of these communicates with a water-jet aspirator, by which a current of air can be sucked through the whole system,

The apparatus being disposed in this manner, the platinum spiral is heated to redness and introduced into the

three-necked bottle. After a few minutes the flameless combustion of the methyl-alcohol begins to manifest itself by the evolution of a vapour powerfully affecting nose and eyes. Gradually the temperature of the apparatus rises, and soon droplets of a colourless liquid are condensed in the receiver. The formation of methyl-aldehyde is now fairly proceeding, and if the current of air be appropriately adjusted, the platinum spiral remains incandescent for hours, and even for days. There is no difficulty in collecting from 50 to 100 grammes of a liquid rich in methyl-aldehyde.

Instead of establishing the current of air by a water-jet aspirator, a pair of bellows may be conveniently employed. I have often used with advantage the bellows of an ordinary glass-blowing table. This mode of proceeding is more particularly adapted to the requirements of the lecturer, who is thus enabled, by simply accelerating the movement of the foot, to enliven the combustion, so as to keep the whole spiral in a state of incandescence. By thus proceeding it happens, however, occasionally that the gaseous mixture in the three-necked bottle is fired; but these explosions are perfectly harmless, the whole effect being the forcible ejection of the loosely-fitting cork which carries the platinum spiral.

The liquid which is being collected in the receiver has all the properties which theory assigns to the aldehyde of the methyl-series, or, more properly speaking, to its methyl-alcoholic solution. When rendered gently alkaline by a few drops of ammonia, and mixed with nitrate of silver, it yields, on gently warming, a silver mirror of unapproachable perfection, which is indeed more readily and more certainly produced than with the aldehyde of the ethyl-series. The reduction in this case is the result of two consecutive reactions; in the first stage the aldehyde yields formic acid, which in the second stage is converted into water and carbonic acid.

On heating the methyl-alcoholic solution of the aldehyde with a few drops of a fixed alkali, the liquid becomes turbid on ebullition, acquires a yellowish colouration, and soon deposits droplets of a brownish oil possessing in the highest degree the peculiar odour of ethyl-aldehyde-resin.

After the observation which I have mentioned it was scarcely doubtful that the product of the slow combustion of methylic alcohol contains the aldehyde of this alcohol in considerable proportion. Nevertheless it appeared necessary to fix the nature of this compound by some numbers. The commencement of the vacations being at hand, there was but little hope of preparing the liquid in sufficient quantity for the purpose of obtaining the aldehyde, which will probably be found to be either gaseous at the common temperature, or extremely volatile, in a state of purity for analysis. Under these circumstances, I have been compelled to limit myself to the preparation of an easily accessible derivative of methyl-aldehyde possessing a characteristic composition, and the analysis of which would not be less conclusive than that of the aldehyde itself. The slight solubility and the powerfully crystalline tendencies of the sulphaldehyde of the ethyl-series could not fail to indicate the direction in which I had a right to hope that the object which I was aiming at might be accomplished.

If a current of sulphuretted hydrogen be passed through the methyl-alcoholic solution of methyl-aldehyde, the liquid becomes turbid after a few minutes, and on allowing the saturated solution to stand for some hours, a body of an alliacious odour begins to be separated at the bottom of the flask. If the liquid be now mixed with half its volume of concentrated hydrochloric acid, and heated to ebullition, it becomes limpid, and solidifies on cooling into a mass of felted needles of dazzling whiteness. These needles fuse at 218° ; they are volatile without decomposition. Slightly soluble in water, they are more readily dissolved by alcohol, and still more so by ether. For the purpose of analysis they were recrystallized from boiling water, in order to exclude free sulphur, with which they

* Read before the Royal Society, November 21, 1867.

might have possibly been contaminated. The numbers obtained in the analysis of the crystals unmistakably establish their nature. The white crystals, as might have been expected, have the composition of the sulphaldehyde of the methyl-series.



The analysis of the sulphur-compound fixes, of course, the presence of the corresponding oxygen compound among the products of the slow combustion of methylic alcohol.

A more minute examination of methylic aldehyde and its derivatives remain still to be made. It will be absolutely necessary to isolate the oxygen-term and to determine its vapour-density, in order to ascertain its molecular weight. If we remember the facility with which the aldehydes are polymerized, the question presents itself, whether the aldehyde formed by the slow combustion of methylic alcohol is represented by the formula



or a multiple thereof. A similar remark applies to the sulphur-derivative. It deserves, moreover, to be mentioned that a compound isomeric with methylic aldehyde, the dioxymethylene ($\text{C}_2\text{H}_4\text{O}_2$) of M. Boutelrow, is known already; also that a sulphur-compound of the formula



has been obtained by M. Aimé Girard, who observed that bisulphide of carbon is reduced by the action of nascent hydrogen with disengagement of sulphuretted hydrogen.

In the course of next winter I propose to perform some former experiments on the product of the slow combustion of methylic alcohol for the purpose, if possible, of isolating methylic aldehydes in a state of purity, in order to complete this inquiry.

ON THE IDENTITY OF

PHYSICAL WITH SO-CALLED VITAL FORCES.

A few weeks ago we gave our readers, in considerable detail, the remarks of Professor Tyndall on "Matter and Force," addressed to the working men of Dundee. As a sort of sequel to them, and in part an application of these questions to a special series of phenomena, we give in similar detail the words of Dr. Letheby addressed to the students of the London Hospital, at the opening of the current medical session. Prof. Letheby, it will be seen, did ample justice to the great and almost limitless powers of physical research when applied to subjects of biology, before treated mainly by powerful imagination and fruitless conjecture, and which were so settled to the satisfaction only of individual conjectures.

But Dr. Letheby took, as Professor Tyndall did, a still bolder position, as our readers will see, and drew a sharp line of separation between the possibilities and impossibilities of the application of our knowledge of force and matter. The range of possibility allowed by Dr. Letheby to science will be seen on examination to be much smaller than that of Professor Tyndall.

Three such authorities as Professor Tyndall, Huxley, and Letheby rarely lecture upon the aims and limits of science in such close succession, and such lectures will go far to give some definition to the present crude and indefinite popular ideas upon what philosophers think of the range of the various sciences.

Dr. Letheby writes as follows:—"We speak of healthy and unhealthy seasons, and in popular discussion are satisfied to refer the pandemic tendency of disease to the state of the weather. But how are they related? The circumstance of a higher or lower temperature than usual, a wetter or drier season, the existence of more or less ozone in the air, the fluctuations of the barometer, &c.,

are, at present, but coincidences of facts; and they offer no explanation whatever of the etiology of disease. The same is also true of the observations which have been made concerning the local peculiarities of epidemics—as the altitude of a place, the condition of its soil, the water level in it, and the presence of putrid effluvia. All these, as in the last case, are but dimly seen to have an influence on disease. We know nothing of their real agency, and yet the wildest theories have been advanced in respect of them. At one time it is dogmatically asserted that epidemics are due to wet in the soil; at another to the water supply of the place. Now, it is the condition of the air which causes them, and then it is our filthy habits. Out of this confusion order must come, and the first step must be towards the investigation of the real nature of specific contagia. When this is known, and the laws which govern their action are determined, the caprices of epidemics will be explained.

"Nor are we much more advanced in the interpretation of healthy phenomena. The fiction of an Archæus, and the mechanical and chemical theories of life, have given place to the dogma of a vital force; but the recent progress of physical science has done much to dissipate our illusions concerning fictitious entities and mysterious forces. The study of physical phenomena, from a dynamical point of view, has led to the recognition of the fact that there is a definite correlation or mutual dependence of physical forces—that the various imponderable agencies, or the affections of matter, which constitute the main objects of experimental physics, namely, heat, light, electricity, magnetism, chemical affinity, and motion, are all correlated, or have a reciprocal dependence; that neither taken abstractedly, can be said to be the essential or proximate cause of the other, but that either may, as a force, produce or be convertible into the other; thus heat may mediate, or immediately, produce electricity, electricity may produce heat, and so of the rest.' 'I believe,' says Mr. Grove, from whom I am quoting, 'that the same principles and mode of reasoning might be applied to the organic as well as the inorganic world, and that muscular force, animal and vegetable heat, &c., might, and at some time will, be shown to have similar definite correlations.' This was said almost a quarter of a century ago, and yet we are only just beginning to recognise the truthfulness of his hypothesis. A former teacher in this school, Dr. Carpenter, whose large acquaintance with physiology and physics, especially qualify him for a searching examination of this subject, has fully confirmed the views of Mr. Grove. He has established the fact that there is not only a mutual relation between the so-called vital forces, which are concerned in the growth, multiplication, and transformation of tissues, in secretion, in muscular and other organic motion, and in nervous action, but that there is also a like relation between vital and physical forces. Believing with Mr. Grove that all these forces are but different modes of action of one and the same agency, he contends that the differences of action are due to the material substratum or medium through which it acts; 'that operating through inorganic matter it manifests itself in electricity, magnetism, light, heat, chemical affinity, and mechanical motion; but that when directed through organised structures, it effects the operation of growth, development, chemo-vital transformations, and the like; and is further metamorphosed through the instrumentality of the structures thus generated, into nervous energy and muscular power.' So that it is the speciality of the material substratum, thus furnishing the medium or instrument of the conversion or metamorphism of force, that marks the differences between physical and vital phenomena. I believe that the time is fast approaching when all special entities for the explanation of physical and physiological phenomena, will be dispensed with, when the fundamental conceptions of matter and motion will be found sufficient for their explanation.

"In the case before us, it is not necessary to suppose that a living cell or primordial germ contains within

itself, in a latent form, the whole organising force which is required to build up the future plant or animal. Nor is it necessary to believe that vital force exists in a dormant condition in all matter that is capable of being organised, and that the living cell, in growing and multiplying, evokes and utilises it. It is enough that the cell is the medium for the conversion or metamorphosis of external physical forces into what are called vital actions.

"The external force which the cell chiefly converts is heat; and Dr. Carpenter lays so much stress on the dependence of the organising forces of both plants and animals, on the continual agency of heat, that he regards their vital action as the correlation of it. It might, indeed, almost be said that the special and distinctive attribute of a living organisation is the power of converting heat into vital force. In plants it is entirely exercised in the growth and transformation of tissue; but in animals it is also rendered subservient to the production of nervous and muscular forces; and these manifestations of action are always exhibited in tissues, which retain their original cellular constitution. It is remarkable, too, that no cell has the power of performing two different operations at the same time: thus, says Dr. Carpenter, the *assimilating cells*, whose function it is to convert the raw material supplied by food into organisable *plasma*, exercise little or no chemical transformations; they do not undergo change of form; they do not exert any mechanical or nervous power, and they do not reproduce their kind. So, again, the cells which are specially endowed with the powers of *multiplication*, as well as those which are engaged in *reproduction*, have in each case no other vital endowment. It is the same with the *secreting cells*, and with the cells that are concerned in the production of *mechanical movement*, as the contractile cells of muscular fibrillæ, the ciliated cells of respiratory and other passages. Perhaps, also, it is the same with the cells, or cell-nuclei of the *ganglia*, and extremities of nerves which in all probability are the agents of *nerve-force*. This faculty of exercising but one function at a time is a marked peculiarity of physical forces. If, for example, the force derived from chemical action in a galvanic battery be made to act on a fine platinum wire, it will show itself as *heat*; or if it be conducted through a coil of wire placed around a piece of iron, it will exhibit itself as *magnetism*; or if it be conveyed through acidulated water, it will appear as *chemical action*; but all these manifestations of it cannot be fully exerted at the same time. There is, consequently, a certain quantivalence of action; in fact, the idea of the correlation and mutual dependence of forces, involves the necessity of a certain definite ratio or equivalence of action; for as force cannot be created or destroyed, it must ever be acting in some fixed proportion. If, therefore, the heat and light force received by the plant be converted into vital force during the growth and transformation of tissue, there must be a quantivalence of action, and the force must endure. While the cell lives it is exerted in the manifestations of vital phenomena, but when it dies and decays it is converted into chemical action, and then into heat and sometimes light. In the case of the plant the transformation of heat force is chiefly concerned in the production of tissue; and so also in the animal during the processes of growth and repair; but when the latter engages in the main duties of its existence—the development of motion, it resorts to the affinities of its food, and as these are the embodiments, so to speak, of the light and heat, through whose agency they were formed, it may be said that the functions of the animal body are performed through the agency of cosmical force. The plant is the machine or medium whereby light and heat are converted into the force which forms tissue, and the animal is the machine or medium for changing the affinities of the tissue into other manifestations of force, and finally into heat. The one is accompanied by processes of deoxidation, and the building up of compounds; the other by processes of oxidation and pulling down, but throughout the whole of these changes there is the same force operating through different media.

"It follows from this, that there must be some definite relation between food and animal force. Hitherto it has generally been thought that the nitrogenous element of food is the exponent of its value, and that there is a direct relation between the waste of muscular tissue and the amount of work performed. Attempts have, therefore, been made to estimate the relation by observing the amount of nitrogen excreted, as urea, during exercise of different degrees of activity. The results, however, have shown that, under the best circumstances, the actual work performed exceeds that produced by the oxidation of the nitrogenous constituents of the food and worn out muscle by more than thirty per cent, and in some experiments which were made in 1866, by Drs. Fick and Wislicenus of Zurich, when they ascended the Foulhorn, which is 2,000 feet above the Lake of Brienz, in Switzerland, it was ascertained that the amount of work done in climbing the mountain, exceeded by more than three-fourths that which it would have been theoretically possible to realise from the oxidation of muscle, as indicated by the quantity of urea in the urine. Consequently they conclude that muscular force is chiefly, if not entirely, derived from the carbo-hydrogen of our food, and that the muscle is no more than the machine for the production of motion. Like a steam-engine, it converts the affinities of the oxidised fuel into heat, and then into visible motion. Like it, also, its movements must cause decay and necessitate repair. The nitrogenous constituents of our food are chiefly concerned in this last process, and it is very doubtful whether as much force is not expended in this process, as is afterwards produced by the oxidation of the worn-out tissues. In the consideration of this subject, however, we must not lose sight of the fact that there is a difference between sustained and temporary muscular activity. The herbivora, as the horse, the chamois, the stag, &c., are capable of great temporary exertion, but they are not equal to the carnivora for sustained energy; and with our own domestic animals, we find that they are capable of performing most work when they are supplied with vegetable food containing much nitrogen.

"Lastly, I will remark, in illustration of the general tendency of physiological pursuits, that great efforts are being made to determine the constitution as well as the composition of the fluids and tissues of the living body; for there has long been a desire to understand the way in which the common affinities of matter are controlled by the living cell. Broadly, the chemist has ascertained that the chemical functions of the plant are those of reduction or de-oxidation, whereby carbonic acid and water lose oxygen, the residual elements with the nitrogen of ammonia forming tissues. The functions of an animal, as I have said, are of an opposite nature, for instead of building up they pull down; and in using the tissues of plants as food they oxidise them, and finally restore them to nature as carbonic acid, water, and ammonia. 'The two extremes of these changes are,' to use the words of Gerhardt, 'carbonic acid, water, and ammonia, at one end; albumen, gelatine, fat, and cerebral matter at the other;' but the transitions to these extremes are countless, and are as yet almost beyond the ken of science. Who can tell us by what series of transformations the carbonic acid and water, received by the plant, are converted into vegetable acids, sugar, and fat? And still more mysterious are the phenomena, which accompany the formation of tissues. Why is it that a living-cell, as we call it, possesses the power of transforming cosmical forces, light and heat, into cell-force; and in aggregating matter, how is it that it keeps common affinities at bay? That when it dies, as we express it, the matter so aggregated during life, decays, and comes again within the reach of ordinary affinities? What answer can we give to these questions? No other than that organic matter is the designed or appointed medium of these changes; and we can no more explain the phenomena than we can

say why it is that mineral matters are the appointed media of other manifestations, as light, heat, magnetism, and electricity. Such questions are beyond the scope of the human intellect, and mark the limit of our understanding.

"Apart from these questions, however, the chemist has hope that he will penetrate the mystery of organic changes, in so far as the chemical combinations are concerned. Already he has found the clue to many of the vegetable processes of reduction, and has been able to produce a large number of organic compounds from carbonic acid, water, and ammonia, and even from the elements themselves: in fact, of the three great classes of alimentary substances, as Dr. Odling says, the production of the oleaginous is quite within his reach; the saccharine is almost within it; but the albuminous is still far beyond it. He has thus proved that the dogma of a vital-force, which has tyrannised so long over men's minds, has no foundation; for a host of organic compounds can be made artificially.

"And then with regard to the processes of oxidation, which characterise the functions of animals, he has been able to imitate them to a much larger extent; for, by subjecting organic compounds to chemical transformations he has produced a multitude of secondary products like those of the living world; recognising the fact that all secondary products of tissue-transformation are compounds of comparatively simple molecules, from which the elements of water have been eliminated—in other words that they are composed of the residues of other molecules, the chemist has been able, not only to classify them into certain definite groups, but he has also been able to construct them after the fashion of organic nature. *Stearin* has been produced by joining the residues of glycerine and a fatty acid. *Sarcosine*, which is a muscle-product, by putting together the residues of acetic acid and methylamine. *Hippuric acid*, from the residues of benzoic acid and glycosine. *Taurine*, which is a constituent of bile, from the residues of isethionic acid, and ammonia. *Urea*, from the residues of carbonic acid and ammonia, and so of many others.

"In this way 'organic chemistry has achieved,' as Dr. Odling truly observes, 'a great analytical success. The compounds so elaborately built up by the living organism, it has pulled to pieces, and the pieces themselves it had arranged into natural series and groups of associated bodies.' It has also effected *synthetical* processes, and has built up organic compounds from mineral elements; and its hopes are that the entire processes of organic nature, short of making tissue, will ere long be seen and imitated. Presumptuous man! it may be thought, are you not striving for the impossible? In these explorations of vital phenomena, are you not trespassing upon holy ground? Can the finite measure the depths of the infinite? Already we have done so. "The being of a day has pierced backwards into primæval time, deciphering its subterranean monuments, and inditing its chronicle of countless ages. In the rugged court and shattered pavement of our globe, he has detected those gigantic forces by which our seas and continents have changed places; by which our mountain ranges have emerged from the bed of the ocean; by which the gold and silver, the coal and the iron, and the lime, have been thrown into the hands of man as materials of civilisation, and by which mighty cycles of animal and vegetable life have been embalmed and intombed.' 'He has ascended the Empyrean, and by steps of physical research, has reached the visible boundaries of the universe, and has scanned with eagle-eye the mighty creations in the bosom of space. He has marched intellectually over the mosaics of sidereal systems, and has followed the adventurous Phaeton in a chariot which cannot be overturned.' 'Ideas like these, when first presented to a mind thirsting for knowledge, are apt,' says Sir David Brewster, from whom I am quoting, 'to disturb its equilibrium and unsettle its convictions.

Should this be the mental condition of any one of you, be not alarmed for its results, for this species of scepticism is the infant condition of the uncurbed and generous intellect. There can be no convictions where there have been no perplexities and doubts; and that faith which comes in the train of early scepticism will finally rest upon an immovable foundation.'

"'Credulity, on the contrary, is a disease of feeble intellects and ill-regulated minds. Believing everything, and investigating nothing, the mind accumulates errors, till its overgrown faith o'er-masters its untutored reason. Such a facility of belief may in some cases claim the sympathy even of philosophy; but when it spurns the strict demands of inductive truth, and plants imagination at the door of the temple of science, it cannot be too severely reprobated, or too sternly shunned.'

PROCEEDINGS OF SOCIETIES.

MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY.

MICROSCOPICAL AND NATURAL HISTORY SECTION,

November 4th, 1867.

J. SIDEBOTHAM, Esq., in the Chair.

The Rev. J. E. VIZE showed and presented to the section four specimens of insects beautifully mounted in balsam by himself.

Mr. SIDEBOTHAM read the following "Note on the Ship-barnacle":—

On the 28th of September I was at Lytham with my family. The day was very stormy, and the previous night there had been a strong south-west wind, and evidences of a very stormy sea outside the banks. Two of my children came running to tell me of a very strange creature that had been washed up on the shore. They had seen it from the pier and pointed it out to a sailor, thinking it was a large dog with long hair. On reaching the shore I found a fine mass of barnacles, *Pentalasmus anatifera*, attached to some staves of a cask, the whole being between four and five feet long. Several sailors had secured the prize, and were getting it on a truck to carry it away. The appearance was most remarkable, the hundreds of long tubes with their curious shells looking like what one could fancy the fabled Gorgon's head with its snaky locks.

The curiosity was carried to a yard where it was to be exhibited, and the bellman went round to announce it under the name of the sea lioness, or the great sea serpent.

I arranged with the proprietor for a private view, took my camera and a collodio-albumen plate, and obtained the photograph I now exhibit. The afternoon was very dull, and the plate would have done with a little longer exposure, but this, along with the specimens I show, will give some idea of the strange appearance of this mass of creatures.

This barnacle is of interest as being the one figured by Gerard as the young of the barnacle goose. As some of our members may not have seen the book and read the quaint description, I have brought my copy of Gerard's *Herbal* for their amusement.

I may just mention that another mass of barnacles was washed up at Lytham, and also one at Blackpool, the same day or the day following. I did not see either, but, from description, neither was so fine as the one I have described.

This mass of barnacles was evidently just such a one as that seen by Gerard at the Pile of Foulders. It is rare to have such a specimen on our coasts. The sailors at Lytham had never seen anything like it, although some of them were old men who had spent all their lives on the coast.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, Dec. 4, 1867.

Chalices and Patera of Aluminium Bronze—Alloy of Silver and Aluminium, "tiers-argent"—Induction Coil Experiments—Reaction of Iodine, Mercury, and Zinc—Eruption of Vesuvius.

THE Bishop of Dreux Brize formerly applied for chalices of aluminium, either pure or mixed with other metals, to be used on account of their lightness, beauty, and solidity. This demand was not responded to favourably at first, but M. Paul Morin, after many attempts, succeeded. Chalices and patera in aluminium bronze, forbidden by a decree of 5th August, 1865, have been accepted on the condition that the cups of the chalices and the patera be first silvered and then gilt in the portions prescribed by the rubric. We do not doubt that this favour will be soon extended to chalices and other objects in aluminium, alloyed with a third of silver, which gains ground every day, and will become very popular in spite of the obscurity in which the jury of the Exposition have left it. It is, as its name indicates, "tiers-argent," an alloy of one-third silver with two-thirds of aluminium, that has been rendered homogeneous, at first with much difficulty, but now of easy fabrication. The selling price is 90 francs the kilogramme, and the old metal is re-purchased at 75 francs. The spoons, forks, and salvers of this alloy leave nothing to be desired; it possesses a hardness superior to that of silver, and it can be more easily engraved. If we are well informed, the idea of the "tiers-argent" belongs to M. Alfred Taloureaux, the inventor, along with his brother of bituminised tubes celebrity. M. De Ruolz, associated at a later period with this new industry, remains the possessor of it, and carried on the business with M. Moustet, successor of Lebrun, 116, Rue de Rivoli.

M. Rondel, of Brive, communicates to us the following:—If, while the current of a pile passes through the primary wire of a coil, one of the extremities of the secondary wire is brought near one of the extremities of the iron core, sparks can be drawn of remarkable intensity and brilliancy; if, at the same time, the other end of the secondary wire is put in communication with one of the poles of the pile, a great increase takes place in the brilliancy of the spark. Then, on touching with the hand the iron core, and placing the free end of the wire in contact with the skin, a redness takes place, and a smart stinging sensation is felt. This last experiment was made upon a coil the core of which, completely isolated in a tube of varnished glass, was eight millimetres in diameter.

M. Rondel made the same experiment with another bobbin, the soft iron of which was 12 centimetres long, 5 centimetres wide, and 8 millimetres thick. The sparks were produced with detonations. A single Bunsen element of small size was sufficient to produce these phenomena.

When two recipients are charged with mercury and water, and fragments of iodine are added, we do not perceive any effect. But if a small piece of zinc is allowed to fall into the mercury, the fragments of iodine are instantly set in motion, and are rapidly dissolved. This solution poured off clear serves for many uses. M. Rondel has employed it concentrated for the supplying of a pile mounted in a closed flask, also for the preparation of a fine red iodide of mercury.

Signor Giordano writes to us from the Naples University, with respect to the present eruption of Mount Vesuvius.—

"There is a new conflagration of Vesuvius; I have made several excavations there, and I have just returned at this moment; and faithful to my old habits I hasten to describe what has passed from the first instant of the eruption to the present time.

"After the irruption of last year the volcano remained in the most perfect tranquillity. But on the 13th of this month, at 1 o'clock in the morning, without any previous

warning, and only with a slight noise, the mountain commenced to project, at first incandescent stones, and afterwards liquid matter by four igneous openings, or craters properly so-called. Neither I nor any other person could positively affirm whether these craters were opened simultaneously or one after the other, and in what order, as no person was on the volcano at that hour, and the first visitors only ascended at an early hour on the following day. The first of these craters is placed at the east of the two cones of last year; the second at half the height of the great cone to the S.E. on the side of the village of Boscoviale; the two other smaller ones on the current of the lava of last year. Only the second of these craters rejected melted matter, that is to say, a current of lava which by degrees spread and filled up the cavities of the plateau at the summit of the mountain.

"If we judge by the effects produced, the commencement of the irruption from the first instant must have been very strong, although neither the sound nor the earthquake were prolonged to a great distance, because the whole of the surface of the great cone presented long crevasses in different directions. Thus, it was feared that the irruption would be neither feeble nor of short duration. And, in reality, in three days all the crater was filled with lava up to the night of the 16th and 17th, when it commenced to flow over in the currents on the external side of the cone towards the north and north-west; thus were three currents flowing at the same time, uniting together at 20 or 30 meters distance from the edge. These currents encumbered the passages most convenient for ascending and descending the mountain, and the visitors were of course more obstructed than ever.

"At present the stream of lava does not advance any further, but the four above-mentioned cones, and a fifth, which has just appeared, are in violent eruption. The central cone has gained much in height, so as to attain the ten meters which separate its base from the edge of the great crater, so that it can be plainly seen from Naples, towering above the summit of the mountain. The substance of the lava is always the same, that is to say, *augitophyre*, and all the ground in the environs of the small cones is covered with the ordinary chlorides of different colours."

F. MOIGNO.

NOTICES OF BOOKS.

A Programme of Atommechanics; or, Chemistry as "Mechanics of the Panatoms. By GUSTAVUS HINRICHS Professor of Physics, Chemistry, and Mineralogy at the Iowa State University; Chemist of the Geological Survey of Iowa, &c.

It must be confessed that scientific men in Europe are not, as a rule, accustomed to look to America, or rather to Americans, for new lights in science, and when such lights appear on the American horizon, it is generally found that the philosopher is a foreigner. Americans appear to be too eager for an immediate and material return for their intellectual capital to devote themselves to the more recondite forms of scientific speculation. That Americans are *capable* of any amount of work of mind or body, that they are eminently clever and ingenious, we freely admit, but few will even attempt to deny that American scientific literature does not, as yet, hold so high a position as might be desired. It is therefore with great interest that we receive any contributions to science emanating from that great country. That the public feeling in America is against us we are unfortunately aware; and this dislike to England takes, among many others, the form of underrating English science, and, whenever possible, French or German models are used by professors to hold up to the study or

emulation of their pupils. Being aware of this, and knowing also that in England we not only bear no animosity to America, but are anxious to cultivate her friendship, we are very unwilling to criticise too harshly any scientific treatise emanating from our brethren on the other side of the Atlantic. But the name of the author of the work, the title of which we have quoted above, is so obviously German that we trust we may indulge in a few remarks upon his treatise (so long as we keep within the limits of fair criticism) without hurting the susceptibilities of any of our American brethren.

The author of this work has sent us a printed sketch of his production, but we may at once confess that the materials before us are insufficient to induce us to follow his argument in detail, and we can therefore only lay them before our readers accompanied by such comments as naturally present themselves.

The author includes in his "Programme" some historical remarks, and he especially states that he made the discovery of "Pantogen" in 1855 when studying at the Polytechnic School of Copenhagen. This pantogen, or "Urstoff," as M. Hinrichs writes it in German, is, in fact, the one primary or truly elemental matter of which all the so-called elements of the chemist of the present day are made up. It is almost impossible within the limits of an article like this to state the reasons which the author gives for assuming the existence of pantogen; and then for concluding that, by assuming the existence of one primary elemental matter, and calling it by a specific name, he has discovered this only true element.

It is needless, perhaps, to say that, like all discoverers of this class, he falls back continually on "analogy." This too free use of analogy has been the bane of science from the time of Plato, and it would appear that the race of speculators who mistake fanciful analogies for fundamental scientific laws is by no means yet extinct.

M. Hinrichs finds that "the history of science is one and the same," and that "we may therefore learn the history of chemistry by studying that of her elder sister, astronomy." He also finds that:—"Lavoisier is the Copernicus among chemists; both pierced the veil of appearances, and discovered the true order of things. Copernicus found the earth too insignificant to move the heavens. Lavoisier found the metal lighter than its ash (oxide). Modern chemistry—not the chemistry of most of our textbooks—is truly Keplerian. The beautiful laws of *Dulong* and *Petit* (specific heat of the atoms), of *Gay Lussac* (volume of atoms), of *Mitscherlich* (on isomorphism), &c., were grasped by *Gerhardt* (chemical types), and now make modern chemistry an exact science. The great discoveries in organic chemistry, from *Liebig* to *Berthelot*, and the spectral analysis of *Bunsen* and *Kirchhoff*, have made the domain of chemistry as universal as that of astronomy.

"We may venture to conclude that this parallelism in the history of astronomy and chemistry does not end here. The history of astronomy since 1619, when Kepler's third law was discovered, may teach us what changes await modern chemistry.

"We must conclude from this analogy that there exists some general principle which will transform modern chemistry into a *mechanics of the atoms*; for about fifty years after *Kepler* astronomy had become a mechanics of the heavenly bodies, i.e., of *cosmical atoms*!

"The basis of this celestial mechanics (as Laplace so fitly termed astronomy) is but a *hypothesis*,—that of universal gravitation,—which essentially consists in the affirmation that the heavenly bodies only differ in regard to the amount or quantity of matter.

"Let us have the boldness to pronounce a similar hypothesis in regard to the chemical atoms. Let us suppose that the atoms of the different elements only differ in regard to *quantity*—that is, in regard to the *number* and relative *position* of the atoms of some one primary matter, just as the planets only differ according to the *number* of kilogrammes of ponderable matter they contain, and its

distribution around their axes. Since everything thus would be composed of this one primary matter we call it *pantogen*, and its atoms *panatoms*."

We have felt bound to give this long quotation in order to show the method adopted by our author, and the way in which "pantogen" was "discovered."

It must not be supposed for an instant that what we have said gives more than an exceedingly minute idea of our author's "Programme." By assuming the hypothesis of pantogen he is enabled to explain and calculate all the physical, chemical, and morphological properties of the elements and their combinations, which *may be calculated* just as the orbit of a planet is calculated. He is also enabled to ascertain the atomic constitution, and from them to calculate the *atostere* (specific volume), fusing and boiling point, refracting power, and, to some extent, spectral lines. From all this it is obvious, we think, that M. Hinrichs' work is by far the most wonderful production of modern times, and its author certainly the most remarkable man in his adopted country. It is then then with feelings of profound astonishment that we learn that the author's paper containing the first instalment of his researches promised to the world on page 4 of his "Atomechanik," was refused admission into *Silliman's Journal*, although the MS. only contained 31 pages large quarto! His second paper "On the Trimorphism of Titanic Acid," met the same fate, "only more so."

How M. Hinrichs arrives at his results we do not know until we see his work. We must confess that from the slight glimpse we obtain of his mental process, as seen in his "Programme," we fancy that the results are obtained by arguing backward and writing forward. He confesses to using principally "the method of successive approximations." To deduce all the physical characters of a substance with the aid of the hypothesis of pantogen must tax the resources of this method somewhat severely. The mere fact that the addition of C_2H_4 to a group in one case raises its fusing point 2°, and that the addition of C_3H_6 in another case reduces it 4°, must, we think, be somewhat difficult to explain, even by one who has the "Atomechanik" at his fingers' ends; but there is one feat which cannot, we feel sure, be beyond the resources of the author of the work alluded to, and if he only accomplish it we will "pronounce" at once in his favour, and instantly send in our adhesion to the new theory; the feat we allude to is simply to isolate pantogen.

AGRICULTURAL CHEMISTRY.

- I. *Report of some Experiments in Agricultural Chemistry carried out in the Laboratory of the Royal Agricultural College.* By ARTHUR H. CHURCH, M.A. Oxon, F.C.S. (Practice with Science, vol. i., series ii., No. 6).
- II. *Report of Experiments on the Solubility of Phosphates.* By R. WARRINGTON, jun., F.C.S., Assistant to the Professor of Chemistry, Royal Agricultural College, Cirencester, (Practice with Science, vol. i., series ii., No. 4).
- III. *Notes on some of the Circumstances which determine the Agricultural Value of the Natural Phosphates, with a brief account of the present Method of Analysing them.* By R. WARRINGTON, jun. (Practice with Science, vol. i., series i., No. 7).
- IV. *On the Capillary Action of Soils.* By JOHN WRIGHTSON, F.C.S., Professor of Agriculture in the Royal Agricultural College, Cirencester (Practice with Science, vol. i., series ii., No. 3).

WE have given, nearly in order of importance, the headings of the various papers which give a summary of the researches that have been carried on, during the last few years, by the different chemists connected with the Cirencester Agricultural College. The papers will be found in full in the 1st volume of "Practice with Science"—a work

* Practice with Science—a series of agricultural papers—vol. i. London: Longmans, Green, Reader and Dyer. 1867.

capitally printed, indexed, and arranged, as fit to be placed on the drawing-room table as on the shelf of the chemist or agriculturalist's library. The 1st volume contains, besides these papers, much valuable matter of a more technical kind. We hope, however, on an early opportunity, to do ourselves the pleasure of noticing separately Professor Church's wheat experiments, by which it is shown how to estimate tolerably, by a cursory inspection and examination, the various ratios of starch to nitrogenous matter contained in wheat grains.

The highly ammoniacal Peruvian guano was examined by Professor Church in the three following ways:—1 was a specimen quite fresh; 2 was dried at 100°, when more than 50 per cent by weight was lost; 3 was examined after being kept for a few months. The ammonia from the 1st experiment was ascertained to be 20·55 per cent, corresponding to 16·92 per cent of nitrogen calcium; and magnesium phosphates, 16·98, with a quantity of P₂O₅, in the alkaline estimation, equivalent to 79 per cent. The ammonia lost by experiment No. 2 amounted to 10·49 per cent, leaving thus a percentage of nitrogen of 7·72, as compared with 16·95 given by the 1st experiment. After 12 months' keeping the nitrogen amounted to only 9·08 per cent, as compared with the nitrogen contained in the 1st sample; this shows a loss of 7·87 of nitrogen by 12 months' keeping. Professor Church remarks that this fact points strongly to the probable advantage to be derived from fixation by the sulphating process of such guanos.

In an analysis of acorns, upon which Professor Church informs us, horses and sheep will feed readily, the kernels, husks, and entire acorns were examined. The kernels contain 3·08 per cent of albuminoids, compared with 1·83 in the husks, starch, cellulose, and sugar; 47·17 in the kernels, as opposed to 44·33 in the husks; while the husks gave 26·59 per cent of insoluble fibre, the kernels 2·58 only. This large proportion of calorific food is sufficient, we think, to justify Mr. Church in a series of determinations of their comparative economic use, and also for settling to what cause the harsh flavour of the kernel is to be assigned, and whether this drawback could be removed by any simple process. Acorns and horse-chestnuts may yet, by judicious chemical treatment, be sources of profitable nutriment.

As regards the alleged value of spentgalls from chemical works as a manure for market garden crops, from a sample supplied by Messrs. Hopkin and Williams, Prof. Church does not give much hope. "At present it would be premature to affirm that they are worth purchasing at all." The value seems to be either mechanical upon certain soils, or chemical merely from the carbolic acid evolved during putrefactive decay.

Sugar boilers' scum, on the other hand, affords much calcium phosphate and an appreciable quantity of nitrogen. This scum may be obtained in large quantities and at a cheap rate.

Apropos of Farnham, of workhouse celebrity, our readers will doubtless recollect that before the current month, the place was celebrated for its interesting formations of greensand and gault, and the commercial working of the coprolites there into phosphatic manures. The question of the applicability of these fossil excreta to manure, has gained much attention, and thus Professor Church was induced to examine for them the junction of the greensand with the upper chalk in Wiltshire, near Calne. They were found to contain very much calcium carbonate, a larger quantity of sulphuric acid being thus required for their manufacture into manure. It is estimated, in the paper under notice, that these Calne coprolites are worth about 28s. per ton; referred to the standard of those of Cambridgeshire, the latter show a value of 40s. per ton; the phosphates here are equal to about 55 per cent of tricalcic phosphate.

In the succeeding paper Professor Church finds that from the improved method of extraction of the oil from hard kernels, only about 20 per cent of oil remains in

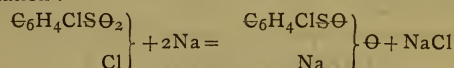
palm-nut kernel meal (in one case 17 only), as compared with 26 and upwards found some time ago by Dr. Voelcker.

The last of this interesting series of chemical research is in some respects the most interesting of all. The injurious effects of mangold leaves in feeding young animals induced Professor Church to try and find the cause of this. The method of conducting the experiment is given in detail, and further researches we hope will be instituted, from the value already gained Mr. Church arrives at the determination, that 100 lbs. of fresh mangold leaves contained rather more than 4 ounces of the soluble acid oxalate of potassium; with the remark that in dry seasons this amount may be possibly increased. This must conclude the 1st part of our notice of these interesting chemical papers. They only require an attentive perusal for their great and full value to be immediately recognized.

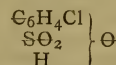
(To be continued.)

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Sulphochlorbenzolic Acid, and Derivatives of.—R. Otto and L. Brummer. Chlorinated or brominated substitution compounds of benzol or toluolsulphurous acid cannot be obtained by the direct action of chlorine or bromine, but may be prepared by treating chlorinated sulphobenzolic (or toluolic) chloride with sodium-amalgam. The reaction takes place according to the equation:



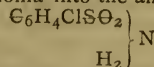
Sulphochlorbenzolic acid is obtained by dissolving chlorobenzol in sulphuric acid, neutralising with plumbic carbonate, and decomposing the plumbic sulphochlorbenzolate with sulphuretted hydrogen. The aqueous solution of the acid is evaporated on the water-bath, and the syrupy mass thus obtained becomes crystalline on cooling. It is readily soluble in alcohol, insoluble in ether and benzol. Its formula is:



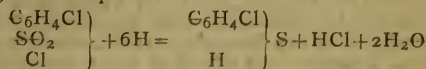
On acting upon the sodic salt with phosphoric pentachloride, sulphochlorbenzolic chloride,



is formed; it crystallises well, fuses at 50—51°C., is insoluble in water, soluble in ether and benzol; it dissolves in alcohol with formation of its ether. Fuming nitric acid converts the chloride into nitrosulphochlorbenzolic acid; alcoholic ammonia into the amide



—nascent hydrogen into chlorophenylic sulphhydrate, according to the equation:

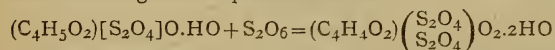


The sulphhydrate forms beautiful large crystals which are soluble in ether, benzol, and hot alcohol, insoluble in water, add fuse at 53—54°. It is converted into chlorophenylic disulphide on being gently heated with nitric acid:



This sulphide crystallises well, is insoluble in water, soluble in ether and hot alcohol, and fuses at 71° ; it may be reconverted into the sulphhydrate by nascent hydrogen. Chlorbenzolsulphurous acid is converted into sulphochlorbenzolic chloride on being treated with chlorine, and into chlorbenzylsulphhydrate (identical with the mercaptan from sulphochlorbenzolic chloride) when subjected to the action of nascent hydrogen.—(*Ann. Chem. Pharm.* cxliii. 100.)

Oxyethylenedisulphonic Acid and New Formation of Isethionic Acid.—Th. Meves. The author prepares isethionic acid by the following method:—Equal weights of dehydrated baric sulphovinate and sulphuric anhydride are mixed together, and the mixture is heated on the water-bath after the first violent reaction is over. The black mass thus obtained is dissolved in water, the solution boiled for several hours, and, after dilution, neutralised with baric carbonate, filtered, and the filtrate precipitated with potassic bicarbonate. The filtrate thereof is evaporated to dryness, and extracted with alcohol, which dissolves potassic isethionate. Oxyethylenedisulphonic acid is obtained by the action of sulphuric acid on isethionic acid according to the equation:—



It is prepared by heating one part of potassic isethionate with three parts of fuming sulphuric acid, dissolving in much water, and neutralising with baric carbonate. The baric salt is converted into the potassic salt, and the latter crystallised out. The free acid obtained from this by decomposition with sulphuric acid forms a syrupy liquid of strong reaction which does not crystallise.—(*Ann. Chem. Pharm.* cxliii. 196.)

MISCELLANEOUS.

The Royal Society.—At the anniversary meeting on November 30, 1867: the following elections took place, *President*.—Lieut.-General Edward Sabine, R.A., D.C.L., LL.D. *Treasurer*.—William Allen Miller, M.D., LL.D. *Secretaries*.—William Sharpey, M.D., LL.D.; George Gabriel Stokes, Esq., M.A., D.C.L., LL.D. *Foreign Secretary*.—Prof. William Hallows Miller, M.A., LL.D. *Other Members of the Council*.—Frederick Augustus Abel, Esq.; William Benjamin Carpenter, M.D.; Prof. A. Cayley, LL.D.; J. Lockhart Clarke, Esq.; John Evans, Esq.; Capt. Douglas Galton, C.B.; John Peter Gassiot, Esq.; John Hall Gladstone, Esq., Ph.D.; Sir Rowland Hill, K.C.B., D.C.L.; William Huggins, Esq.; Thomas Henry Huxley, Esq., Ph.D.; Prof. John Phillips, M.A., LL.D.; Prof. Andrew Crombie Ramsay, LL.D.; Colonel William James Smythe, R.A.; Lieut.-Col. Alexander Strange; Thomas Thomson, M.D.

Obituary.—We have to record the death of Dr. Thomas Clark, late Professor of Chemistry in Marischal College, Aberdeen: his decease occurred on the 27th November, at Clydeview. Dr. Clark's methods of testing and purifying water are well known. The soap test devised by him has been used by chemists for twenty-five years without receiving modification or improvement in their hands. This process for softening water on a large scale is also much used at the present time, and was indeed mentioned by several fellows in a discussion at the last meeting of the Chemical Society. The subject of water seems to have been the one to which Dr. Clark specially devoted himself, and to which almost all his papers in scientific journals refer: his writings have a peculiar charm in them from the modesty with which he expresses himself. Though not a Fellow of the Royal Society, Dr. Clark, had he lived, probably would have been made one at the next election, since his friends were circulating a certificate for signatures.

Royal Institution of Great Britain.—At the General monthly meeting, Monday, December 2, 1867. Sir Henry Holland, Bart., M.D., D.C.L., F.R.S., President, in the chair. George Willoughby, Esq., M.I.C.E., F.R.G.S., William Daniel Michell, Esq., and Morgan Bransby Williams, Esq., M.I.C.E., were elected members of the Royal Institution.

Professor Naquet.—M. Naquet, the distinguished Professor of Chemistry of the Paris University, who was lately arrested for political reasons, has been transferred from Mazas to a *maison de santé*, on the intervention of Dr. Wurtz, the Dean of the Faculty of Medicine. The very valuable work of M. Naquet has lately been translated into English, and published, by Mr. Cortis of Guy's Hospital. M. Naquet is a great favourite with the students, and a very accomplished man of science. His arrest for political reasons has caused a sensation of deep pain in the faculty and schools of Paris.—*British Medical Journal*.

New Reflecting Telescope to be used at Melbourne, Australia.—The Rev. Dr. Robinson, F.R.S., gives the following description of the new Reflecting Telescope recently made for the Melbourne Observatory, in a letter to the President of the Royal Society. "As you express a wish to know my recent impressions respecting the great telescope, I can say that they are very satisfactory. When I saw it six weeks ago the first of the two great specula was just polished; and though the essential parts of the equatoreal were in position, and one could estimate the facility with which it could be managed, the optical part of the telescope remained incomplete. Now, I found the great and small specula in their places, a finder of four inches aperture attached, the circles divided, and the clock for driving the telescope enshrined in the pier. One thing was wanting, weather fit for trying its power; and during eighteen nights there was only one of even middling goodness. That, however, was sufficient to prove that the instrument is thoroughly up to its intended work. I examined several nebula and clusters, with whose appearance in Lord Rosse's six-feet reflector I am familiar, and the difference was far less than I expected. I may specify among them 51 Messier, whose spirals were seen on strong aurora and the nebula in Aquarius, with its appendages like the ring of Saturn. Its definition of stars is very good: α Lyræ had as small and sharp an image as I ever saw on such a night; and a few pretty close double stars were well and clearly separated. Part of this is probably due to the lattice-tube, which permits the escape of heated air, but more to the figure of the speculum, which is truly parabolic. The peculiar nature of the mounting brings the circles completely within reach of the observer's assistant; and the mechanical appliances for the motions in right ascension and polar distance are so perfect, that we set the instrument on the faint objects which we were examining with great facility and rapidity. One man can reverse the telescope in a minute and a quarter; the quick motion in polar distance is of course far easier, and the slow one acts more like the tangent screw of a circle than the mover of such a huge mass. The clock is rather gigantic, but does it works with great precision, the objects which I examined remaining steady on the wire as long as I watched them; and there is an ingenious and new contrivance for suiting its speed to planets or the moon. There remain but a few matters to be completed; the second great speculum is nearly polished, the glass small one is ready; the micrometer and observing-chair are not commenced, nor the photographic apparatus and spectroscope. These two last are no part of Mr. Grubb's contract; but the committee thought themselves justified by the correspondence in ordering them, as their cost is small, and they will add greatly to the utility of the telescope. In the fine sky of Melbourne it will, I trust, yield spectroscopic results surpassing any that have as yet been obtained. That it

will realise fully the expectations of the people whose enlightened liberality has ordered its construction I am quite certain; but I am not so certain that it will retain its present perfection very long if exposed without some shelter. It is true that Mr. Cooper's great achromatic has stood exposed to the rain and wind of Connaught for more than thirty years, and is still serviceable; but besides its inferior size it is of coarser workmanship, and is provided with fewer of those beautiful contrivances which in this instrument make its movements so easy. At Melbourne the rain of Markree is not to be feared; but if one may judge from its position on the verge of a great continent, and from the analogy of India and the Cape, another enemy is to be dreaded, the fine dust which winds from the interior will probably bring. This would find its way into all the bearings, and besides clogging their action would grind them out of truth. The danger of this induces me, after careful discussion with Messrs. Le Sueur and the two Grubbs, to lay before you my views, which (if you think them sound) you may hold it advisable to mention to the authorities of Victoria. Three modes occur to me of covering the telescope. In any case it must be surrounded by a wall, for the comfort of the observer and to prevent intrusion. This wall may support a moveable covering of such a kind as to let the instrument be pointed to every part of the sky. The most usual form of this covering is a dome running on a circular railway, and with an opening or chase on one side reaching from its base to its summit, and closed by a sliding shutter. The disadvantages of this plan are that the performance of the telescope is somewhat injured by currents of warm air rising through the chase, and that it is much heavier and more costly than either of the others. In this instance its diameter could not be less than 56 feet; and though that magnitude is not beyond the resources of an accomplished engineer, yet it is not one to be encountered without the prospect of some adequate advantage. The largest dome which I know (Sir James South's, of 36 feet diameter) is a total failure; but this does not weigh much with me; for, though planned by the celebrated Brunell, it transgresses against the elements of mechanical science. A much simpler plan is the sliding roof. In this case the walls are rectangular, enclosing a space rather broader than the instrument, and about three times as long. The longer sides carry two rails, on which runs a kind of house long enough to cover the instrument and pier, and high enough to clear the latter. That end which at Melbourne will be its north is closed by doors, which are opened at the time of observation, and the roof is wheeled away, leaving all in the open air. It will be the cheapest and least bulky of the three. Its defects are, that the open end presents some engineering difficulty, that the roof will hide about 12° under the pole, and that the whole machinery is exposed to any dust that may be stirring during the hours of observing. That which appears the best is the revolving roof. Its vertical part is a prism of sixteen sides, six feet high, springing from a ring of cast iron which revolves by rollers on a circular rail borne by the wall. The top is nearly flat, with a chase large enough to let the telescope work freely, which can be covered by sliding shutters. The tube, when in use, would project through the chase, and be essentially in free air, at other times could be lowered and completely sheltered; while the other parts would be as well protected as under a dome. In this case the internal diameter should be about 46 feet, with a chase 16 feet wide. These dimensions would give complete command of the heavens, and such a roof would give less hold to a high wind than either of the others. I enclose a rough sketch of its framing. The panels and the three girders at the top to be of angle-iron, light but strong, and these covered with tin plate. If it were adopted, I suppose the frame would be made here, sent out in pieces, and put together and covered on its arrival. The weight would be about 5 tons. As to its cost, no estimate can be given, as labour costs more at

Melbourne than with us; but in Ireland it would be about £1,200. I will conclude this long letter by telling you how much I am satisfied with our selection of the astronomer who is to work this glorious instrument. He is not a mere mathematician; such a one might be very helpless when he came to the practical details of observing, but he is thoroughly versed in its optical and mechanical requirements, and in the daily work of an observatory. For this last he has been trained by Professor Adams during the past year; one of the Committee, Mr. Warren De la Rue, the first of celestial photographers, has instructed him in the mysteries of that surprising art; and for the last three months he has been constantly in Mr. Grubb's works, studying all the mechanism of the telescope (of which I see he has acquired full command), and taking an active part in the polishing of the great specula. He seems fully to understand this most delicate process; and it is my opinion that, if repolishing becomes necessary, he is fully competent to do it successfully. I may therefore congratulate you in full hope on the inestimable harvest of discovery and triumph which will soon crown this magnificent enterprise."

Utilisation of the Grey Barks.—Mr. Broughton, the quinologist, or quinine chemist, employed by Government at the Neigherry plantations, has produced pure sulphate of quinine from the *Crispa* variety of the *Cinchona Officinalis*. From his analysis it appears that, although the grey barks do not contain quinine, they are among the richest in their yield of alkaloids. Mr. Broughton is conducting experiments for the determination of the best season for cropping the bark on a large scale, the various methods of drying the bark for exportation, the influence of soil, the physiology of the alkaloids, and the effects of mossaing the barks. The question of a ready means of utilising the barks in the form of some simple preparation for therapeutical purposes in India is also receiving his best attention.—*British Medical Journal*.

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3129. H. A. Bonneville, Rue du Mont Thabor, Paris, "Improvements in the method or means for preserving paste matters and substances, and apparatus therefor."—A communication from E. Charton, Rue Lepic, Paris.—Petition recorded November 6, 1867.
3208. A. F. Gaidan, Nîmes, Gard, France, "Improvements in compressed or artificial fuel."—Partly a communication from L. Tresgot, Nîmes, Gard, France.
3219. E. Madge, Swansea, "Improvements in the mode of and apparatus for the reduction of sulphate of iron crystals."—Partly a communication from C. Madge, Carrizal Bajo, Chili.—November 13, 1867.
3226. W. H. Richardson, Glasgow, N.B., "Certain improvements in the manufacture of iron and steel, and in the means or apparatus for effecting the same."
3232. J. Clark, Ph.D., and A. Esilman, Glasgow, N.B., "Improvements in decomposing the sulphides of copper, silver, nickel, cobalt, lead, barium, strontium, and calcium, and in obtaining copper, sulphur, and other products."—November 14, 1867.
3233. R. G. Harcourt, Birmingham, "Improvements in the manufacture and composition of fire lighting material."
3243. A. M. Clark, Chancery Lane, "Improvements in refining copper."—A communication from F. Le Clerc, M.D., Boulevard, St. Martin, Paris.
3244. J. Templeman Glasgow, N.B., "Improvements in the manufacture of fire-lighters, applicable also for temporary fires or heaters, and in the means or apparatus employed therein."—November, 18, 1867.
3243. J. Swindells, Kegworth, Leicestershire, "Improvements in the process of, and in apparatus employed in treating and separating minerals, earths, and other substances when ground or pulverized."
3269. J. G. Tongue, Southampton Buildings, Chancery Lane, "Improvements in the process and apparatus employed for ageing and refining wines, alcohol spirits and other liquors."—A communication from R.D. Turner, New York, U.S.A.—November 16, 1867.
3264. C. E. Brooman, Fleet Street, London, "A new or improved process of and apparatus or furnaces for the manufacture of metal direct from the ore."—A communication from P. E. Martin, Paris.

3270. G. Fitt, Limehouse, Middlesex, "Improvements in the manufacture of artificial manure."—November 18, 1867.

3282. W. H. Richardson, Glasgow, N.B., "Certain improvements in the manufacture of iron and steel."—November 20, 1867.

NOTICES TO PROCEED.

2114. J. Hargreaves, Appleton-within-Widnes, Lancashire, "Improvements in utilizing certain materials or products obtained during the manufacture of steel and iron."—Petition recorded July 19, 1867.

2132. T. A. Breithaupt, Passage des Petites Ecuries, Paris, "Certain processes of manufacturing extract and essence of hop to be substituted for the plant itself in the making of beer."—July 22, 1867.

2166. C. E. Brooman, Fleet Street, London, "Improvements in the manufacture of cast steel and its derivatives."—A communication from E. Martin and P. E. Martin, Paris, July 25, 1867.

2553. J. Eichhorn, Delahay Street, Westminster, "Improvements in furnaces for melting iron and other metals, and for smelting ores."—Partly a communication from H. Krigar, Hanover, Prussia.—September 9, 1867.

2618. T. Bell, Hampstead, Middlesex, "Improvements in treating the oxide of iron residues of gas purifying in order principally to extract sulphur therefrom."—September 17, 1867.

CONTEMPORARY SCIENTIFIC PRESS.

(Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News.")

Comptes Rendus.

September 2, 1867.

DUMAS, "Obituary Notice of Professor Faraday." CHEVREUL, "Obituary Notice of Professor Faraday." CHARLES, "Answer to Faugere's Remarks on the Authenticity of the Pascal Correspondence." SECCHI, "On a Self-recording Meteorological Apparatus in the Champ Mars." "On the Shooting Stars observed on the 10th of August, 1867." "On a Stellar Spectroscope." A. W. HOFFMANN, "On a new Class of Acids homologous with Hydrocyanic Acid." BURDIN, "On the Use of Hot Air instead of Steam as a Motive Power." P. DESAINS, "Researches on the Absorption of Obscure Heat." A. OPPENHEIM, "New Researches on the Isomerism of Protochloride of Allyl and Monochlorinated Propylene." A. GAUTIER, "On Chloride of Hydrocyanic Acid." M. SIMPSON and A. GAUTIER, "On the direct Combination of Aldehyde and Hydrocyanic Acid." J. Y. BUCHANAN, "On some Derivatives of Isethionic Acid." PHIPSON, "On the Presence of Columbite in Wolfram." A. BAUDRIMONT, "On the Chemical Composition of the various Kinds of Guano imported to Bordeaux during the last Twelve Years."—September 9.

CHARLES, "Answer to some further remarks by Faugere on the Authenticity of the Pascal Correspondence." A. SECCHI, "On the History of the Static Barometer." A. W. HOFFMANN, "On a new Series of Homologues of Hydrocyanic Acid." FAUGERE, "Some further Remarks on the Authenticity of the Pascal Correspondence." J. M. GAUGAIN, "On the Polarisation of the Electrodes of the Voltaic Battery." BERTHELOT, "On some Hydrocarbons contained in Coal Tar. Styrolene. Cymene. Hydride of Naphthalene. &c." A. GAUTIER, "On a new Series of Isomers of the Fatty Hydrocyanic Ethers." "On a new Base derived from Hydrocyanic Acid."

Monatsbericht der Königlich-Preussischen Akademie der Wissenschaften zu Berlin.

June, 1867.

POGGENDORFF, "On the Motion of Quicksilver in Glass Tubes under the Influence of the Electric Current."

Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften zu Wien. (Mathematisch-naturwissenschaftliche Classe.)

March, 1867.

G. TSCHERMA, "On Glaucodote and Danaite."

Bulletin de la Société Chimique de Paris.

May, 1867.

J. KOLB, "On the Theory of the Manufacture of Soda by Leblanc's Process." LOUGUININE and LIPPMAHN, "On the Preparation of Cymene by treating Camphor with Perchloride of Phosphorus." P. ALEXEYEFF, "On Crystallised Nitrotoluol." E. GRIMAU, "On the Constitution of Benzoin, Hydrobenzoin, and some allied Substances."

June.

E. MONIER, "An Improved Hair Hygroscope." PHIPSON, "On a Method of Detecting the Presence of Iodine and Bromine in the same Solution." LECOQ DE BOISBAUDRAN, "A new Method of Estimating Copper." C. FRIEDEL and A. LADENBURG, "On a Silicic Mercaptan." E. GRIMAU, "On the Brominated Derivatives of Gallic Acid." J. J. CHYDENIUS, "On Hexylene-Pseudo-Urea." F. SESTINI, "On Wax of coccus carice." MALLET, "On the Manufacture of Chlorine and Oxygen from Subchloride of Copper." ANTHOINE and GENOUD, "An improved Iridescent Glaze for Porcelain." "A method of Producing Designs on Agate." PARAF-JAVAL, "On the Transformation of Liquid into Solid Fatty Acids." FERNOD, "A Method of treating Garancin."

NOTES AND QUERIES.

Bichloride of Methylene.—Will you be good enough to let me know the best process for making bichloride of methylene, also any tests for its purity?—J. MILLER. [Some commercial samples of bichloride of methylene have proved on analysis to be little more than a mixture of chloroform and ether.—Ed. C. N.]

Water for Steam Boilers.—Can any one refer me to a work which gives reliable information upon "Waters" with respect to their suitability for supplying steam boilers, or can you tell me what is the physical character of the deposits when the water contains much sulphate of lime or carbonate of lime?—E.S.T.

Watts's Dictionary of Chemistry.—In reply to a query addressed to us by a Subscriber, we are informed by the Publishers of Watts's Dictionary of Chemistry that there is only one sheet now due to the subscribers to that work, as the thirteenth part contained two sheets more than the proper quantity. The missing sheet will be given in a future part.

The Bichromate Battery.—Can any of your readers refer me to a description of the mode of using the bichromate battery? Is it as well suited as Grove's for use with Ruhmkoff's induction coil? Is it as intense and as constant as that battery? Should the zinc plate of it be amalgamated? In what proportion should the saturated solution of bichromate of potash be mixed with strong sulphuric acid?—CLERICUS.

Atomic Weight Queries.—(1.) In p. 2 of Frankland's "Lecture Notes" we read that the atomic weight of an element is made to represent as far as possible "the weight of the element in the solid condition, which, at any given temperature, contains the same amount of heat as seven parts by weight of solid lithium, at the same temperature." A reference to Kopp's researches is, I presume, here made. Where can I find information elucidating the above statement? (2.) On comparing the titles of atomic weights in Watts's "Dictionary of Chemistry," vol. i., p. 465, published in 1863, and in Frankland's "Lecture Notes" p. 6, published in 1866, I find a large number of the atomic weights doubled in the latter. The doubling is I believe due to the researches of Cannizzaro. Where can I find an account of these researches? Dr. Odling, in his article on "Atomic Weights," just referred to, speaks of the objections to Cannizzaro's proposal of doubling the atomic weights as being "too great to admit of its adoption." How then has it become so rapidly adopted?—RUSTICUS.

TO CORRESPONDENTS.

NOTICE.—The Printing and Publishing Offices of the CHEMICAL NEWS are Removed from Wine Office Court, Fleet Street, to

BOY COURT, LUDGATE HILL, E.C.

where all Communications are to be addressed.

S. E. Phillips.—We are by no means so materialistic as our correspondent supposes, and shall be very glad to peruse the article named.

D. H.—"Santonine" was a misprint for "Saponine."

J. D. Barry.—Thompson's Dictionary of Chemistry is in one volume. Watts's Dictionary is the most suitable, but it is in four or five volumes.

Rusticus.—1 and 2. See "Notes and Queries." 3. The best elucidation will be found in Wurtz's "Introduction to Chemical Philosophy," published at our office. 4. Not generally adopted. 5. There is no best method, strictly speaking. Either mode of formulation meets with supporters, and at present there are not sufficient data to enable one to decide between them.

An Old Subscriber.—Is thanked for his communication, we will endeavour to attend to his wishes. There is sometimes difficulty in getting the requisite permission; we think however, that we may promise the lectures this year.

Books Received.—"Cassell's Popular Educator." "The Reducer's Manual and Gold and Silver Worker's Guide," by Victor G. Bluede. London: Trübner and Co. "American Artizan." "Journal of Gas Lighting." "Bulletin Mensuel de la Société Chimique de Paris." "Scientific American." "Proceedings of the British Pharmaceutical Conference." Dundee Meeting, 1867. "A Catalogue of Photographic Apparatus, Chemicals, &c." Murray and Heath, Jermyn Street. "The Pharmaceutical Journal" for December. "Mining and Scientific Press." "American Gaslight Journal." "Hardwick's Science Gossip." "Philosophical Magazine" for December. "American Journal of Mining." "A Manual of Pharmacy, for the Student of Veterinary Medicine." By W. J. T. Morton. London: Longmans.

Communications have been received from Dr. Rohrig; Dr. Attfield; Dr. Odling, F.R.S.; W. Spalding; Dr. R. Angus Smith, F.R.S. (with enclosure); F. O. Ward; I. Baggs; H. K. York; Herr Sensolmer (with enclosure); W. White; H. Morris; T. Reader; S. Muspratt; M. Murphy; C. David; J. Mc Dougall; J. Slater; C. Tomlinson, F.R.S.; Herr H. Kunde; J. Grieverson; J. Walker (with enclosure); J. Malcome; H. Johnson; J. Williams; J. O. M. Wallace E. Riley; J. D. B. Fraser; Rev. Edwin Smith; A. Warner; T. Loveridge; Dr. Davy; Dr. S. Muspratt (with enclosure); Carrell and Co; W. Molyneux; T. Smith (with enclosure); C. Dussace; G. Maurice; H. Hayman; J. Thompson; W. Ladd; Professor Morton; Dr. Quesneville; Professor Heaton; C. Greville Williams, F.R.S.; W. Jameson (with enclosure); Rev. C. W. Kett; Johnson and Sons; Dr. Pattison; Dr. Wilhelm.

THE CHEMICAL NEWS.

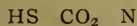
VOL. XVI., No. 419.

ON GAS ANALYSIS.

By Drs. GRANDEAU and TROOST.

(Concluded from page 272).

IV. Mixture of Hydrosulphuric Acid, Carbonic Acid, and Nitrogen.

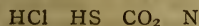


The mixture is measured into a graduated tube standing over mercury. Introduce a solution of sulphate of copper, and agitate. The diminution of volume represents the amount of hydrosulphuric acid present.

Professor Bunsen recommends in preference for the absorption of the hydrosulphuric acid, a ball of binoxide of manganese impregnated with phosphoric acid. [To obtain a ball of binoxide of manganese which does not tend by reason of its porosity to absorb other gases besides hydrosulphuric acid, M. Bunsen prepares by levigation a fine powder, which is formed into a thick paste by a little water. This paste is then pressed into a mould round a platinum wire, the extremity of which is twisted into a spiral. The mould is then dried at a gentle heat, when the ball of binoxide is readily detached; for greater precaution, the sides of the mould may be smeared with a little oil. The ball is then moistened several times with a syrupy solution of phosphoric acid].

The remaining gas, transferred to an appropriate tube, is then submitted to the action of caustic potash, which absorbs the carbonic acid. The residue is nitrogen.

V. Mixture of Hydrochloric Acid, Hydrosulphuric Acid, Carbonic Acid, and Nitrogen.

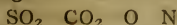


When the exact volume of the mixture has been accurately measured in a tube over the mercury, the hydrochloric acid is absorbed by means of a fragment of hydrated sulphate of soda fixed to the extremity of a platinum wire. [To obtain these fragments it is sufficient, according to M. Bunsen, to fuse ordinary sulphate of soda in its water of crystallisation, and to dip in several times the end of a platinum wire. There attaches to the wire a small lump of the sulphate which augments in volume with each fresh immersion].

Then remove the sulphate of soda, and measure the volume again. The diminution observed will represent the volume of hydrochloric acid gas.

The hydrosulphuric acid is absorbed by a ball of binoxide of manganese soaked in phosphoric acid, and the carbonic acid is afterwards absorbed by potash. The residue gives the nitrogen.

VI. Mixture of Sulphurous Acid, Carbolic Acid, Oxygen, and Nitrogen.

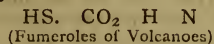


(Gas issuing from Craters of Solfatara).

The volume of the mixture being measured dry in a graduated tube over mercury, the sulphurous acid is absorbed by a ball of binoxide of manganese impregnated with phosphoric acid. After having removed this ball and noted the diminution of volume, a fragment of potash is introduced to absorb the carbonic acid. The second diminution of volume will give the carbonic acid.

The oxygen can then be absorbed by potash and pyrogallallic acid; or it may be estimated eudiometrically as described in No. 1. The nitrogen will remain as residue.

VII. Hydrosulphuric Acid, Carbonic Acid, Hydrogen, and Nitrogen.



Commence by absorbing the hydrosulphuric acid by introducing into the mixture a ball of binoxide of manganese impregnated with phosphoric acid. The absorption of the carbonic acid is then effected by means of a fragment of moist caustic potash.

The hydrogen is then estimated as at No. 2, either by the eudiometer, or by passing the mixture of hydrogen and nitrogen into a curved tube and introducing compact oxide of copper into the upper part of the bend. By heating for a quarter of an hour the part of the tube containing this oxide, the complete absorption of the hydrogen is effected. The nitrogen will form the residue.

VIII. Gas from Blast Furnaces where Wood is used.



After having accurately measured the volume of the mixture over mercury, absorb the carbonic acid with a fragment of caustic potash.

Then estimate the carbonic oxide by introducing into the graduated tube a solution of subchloride of copper in hydrochloric acid, agitate, and the absorption will be complete.

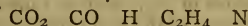
Instead of introducing the liquid itself it will be better, as M. Bunsen advises, to introduce a ball of papier maché impregnated with this acid solution of subchloride of copper.

This experiment should be made over another separate mercurial trough, for the subchloride of copper attacks and fouls the mercury.

In withdrawing the ball impregnated with chloride, before reading off the volume, it is necessary to remove the hydrochloric acid vapours given off by the chloride.

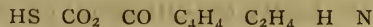
The estimation of the hydrogen can then be effected as at No. 2, either by the eudiometer, or by absorption, with oxide of copper. The nitrogen remains as a residue.

IX. Gas from the Mud of a Pond.



First estimate the carbonic acid by means of potash, then with a ball of papier maché introduce into the mixture a concentrated solution of subchloride of copper in hydrochloric acid. After the absorption has terminated, withdraw the ball of chloride and replace it by a ball of potash to remove the vapours of hydrochloric acid given off by the acid chloride. If the mixture which contains carbonic oxide also contains oxygen, the latter gas is determined first by pyrogallallic acid and potash. The estimation of the hydrogen and carburetted hydrogen is then effected eudiometrically as in No. 3.

X. Coal Gas.



The mixture is first accurately measured in a graduated tube standing over mercury. The hydrosulphuric acid is then estimated by means of a ball of binoxide of manganese impregnated with phosphoric acid.

After removing the binoxide of manganese and measuring the remaining volume, introduce a ball of caustic potash, which absorbs carbonic acid.

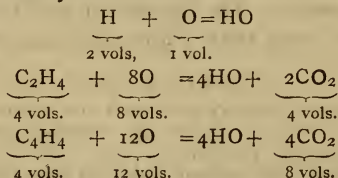
The carbonic oxide is determined by means of acid subchloride of copper.

To determine the bicarburetted hydrogen introduce into the residue a fragment of coke soaked in a concentrated solution of anhydrous sulphuric acid in monohydrated sulphuric acid. The absorption of the bicarburet takes place very rapidly; the coke is then withdrawn and the acid vapours absorbed by potash.

The estimation of the hydrogen and proto-carburetted hydrogen is then performed as at No. 3. The nitrogen remains as a residue.

The bicarburetted hydrogen, as well as the protocarburetted hydrogen, may also be estimated by the eudiometer. To effect this pass the mixture of these three gases and the nitrogen into the eudiometer with three times its volume of oxygen, and pass the spark. The free hydrogen, as well as that of the carburets, combine with oxygen to form water, whilst the carbon becomes carbonic acid. Then pass the residue of the combustion into a graduated tube, and estimate the carbonic acid with potash, and the excess of oxygen with potash and pyrogallic acid. The residue left after this double absorption gives the nitrogen.

The volumes of bicarburetted hydrogen, protocarburetted hydrogen, and hydrogen may then be obtained by a simple calculation. The reactions which take place may be represented by the formula



These equations show us:—1. That the combustion of bicarburetted hydrogen requires thrice its volume of oxygen, that of bicarburetted hydrogen double its volume, and that of hydrogen half only. 2. That the bicarburetted produces double its volume of carbonic acid, and the protocarburetted its own volume exactly.

Therefore, calling x , y , z the volumes of the bicarburetted, the protocarburetted, and the free hydrogen, of which the sum is known and represented by c , we have—

$$\begin{array}{rcl} 3x + 2y + \frac{z}{2} & = & a \\ 2x + y & = & b \\ x + y + z & = & c \end{array}$$

a and b are the volumes of oxygen employed, and of the carbonic acid produced, volumes of which have been determined by experiment.

To find the values of x , y , and z , subtracting the first equation from the sum of the two others, we find—

$$\frac{z}{2} = c + b - a, \text{ whence } z = 2(b + c - a),$$

Then subtracting the last from the second we find—

$$x - 2(b + c - a) = b - c, \text{ whence } x = 3b + c - 2a,$$

The second equation then gives—

$$y = 4a - 5b - 2c.$$

ON THE

ACTION OF LIGHT ON CHLORIDE OF SILVER.

By M. MORREN, Dean of the University of Sciences of Marseilles.

TAKE a glass tube 3 centimetres in diameter, and from 45 to 50 centimetres in length, close one end and introduce two bulbs, one containing nitrate of silver, the other chloride of potassium, in equal equivalents; fill the tube with a concentrated solution of chlorine in water, then carefully seal it before the blowpipe. Break the bulbs by agitation, when the result will be chloride of silver deposited in an excess of chlorine water. If the tube be exposed for several days to the rays of the sun, the following facts may be observed. 1st. As long as the liquid preserves the yellow colour given to it by the chlorine, the chloride of silver remains white. 2nd. When this yellow colour disappears by the action of the chlorine on the water under the influence of light, the chloride of silver slowly assumes, not the very deep violet which we see in the reactions of

photography, but a red brown, which at first only appears gradually and on the surface, but in time penetrates the entire white mass, provided the tube is sufficiently agitated, and submitted to the action of a bright sun. 3rd. The tube being placed, if not in obscurity, at least in the diffused light of the laboratory, the brown colour disappears gradually, and the chloride of silver re-assumes, in all its intensity, its original white aspect. Replace the tube in the sunlight, and the colouration takes place afresh, to disappear again when the tube is returned to the shade, and so on indefinitely. The interesting questions involved in these successive evolutions have occupied me much, and I intend to devote still more attention to them.

ON THE

ARTIFICIAL PRODUCTION OF BENZOIC ACID FROM NAPHTHALIN.*

By Dr. ADOLF OTT.

BENZOIC acid is a crystallizable, soft, white body, inodorous when pure, but smelling like gum benzoin when gently warmed; it usually has a faint aromatic odour, sweetish taste, but produces a burning sensation in the throat. Litmus is feebly reddened by it; it fuses at 250° Fahr., sublimes at 300° Fahr., and boils at 462° Fahr., yielding a vapour of the sp. gr. 4.27. It exists in benzoin, in the tolu balsam, in the gum of *Xanthorrhoea hastilis*, in castor, and has also been met with in the urine of man and herbivorous animals, &c. Benzoic acid is also found by the oxidation and decomposition of oil of bitter almonds, protochloride of benzoil, hippuric acid, &c., and further by the action of a solution of caustic baryta on populin and other organic compounds. It has hitherto, nevertheless, only been prepared from the gum benzoin, either by subliming the same—a process existing since 1703 (*vide* Turquet de Mayerne, "Pharmacopœia in Oper. medio." London)—or by a process, due to Wœhler, which we will here not further describe, as it can be found in nearly any larger hand-book of chemistry. We only will mention that it is used in medicine to some extent, viz., against affections of the throat; largely in the manufacture of aniline blue; and for the preparation of tobacco sauces.

This interesting substance, of which the chemical formula is $\text{C}_{14}\text{H}_6\text{O}_4$, has now lately been produced, at a rate allowing the manufacturer large profits, from a substance which, in its crude state, can be got for less than one cent a pound. In the following I will proceed to describe the process, but first mention something about naphthalin:—

This hydrocarbon (formula C_{20}H_8) was discovered in 1820, by Garden, in the coal-tar of the gas works, and studied by Liebig, Faraday, Wœhler, and others. It is a colourless, inflammable solid, of a burning aromatic taste, and peculiar smell. Its specific weight is 1.048, its melting point 175°, and its boiling point 428° Fahr. It sublimes unaltered in laminae, and can also be obtained in rhomboidal crystals from its alcoholic solution. It is inflammable, and burns with a very smoky flame. Its derivatives have principally been studied by the celebrated Laurent.

The process now by which this hydrocarbon is transformed into benzoic acid is the following:—

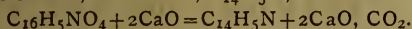
(1.) *By the Process of Laurent.*—The naphthalin is transformed into the α modification of the bi-proto-chloride of naphthalin, $\text{C}_{20}\text{H}_8\text{2Cl}_2$.

(2.) The bi-protochloride of naphthalin is converted by oxidation into phthalic acid, $\text{C}_{16}\text{H}_4\text{O}_6\text{2HO}$, and the latter into phthalate of ammonia, $\text{C}_{16}\text{H}_4\text{O}_6\text{2NH}_3$.

* A paper read before the Polytechnic Association of the American Institute.

(3.) We obtain then the phthalamid, $C_{16}H_5NO_4$, simply by subjecting the phthalate of ammonia to distillation.

(4.) By distilling the product obtained by process 3 with hydrate of lime, benzonitril, $C_{14}H_5N$, is formed.



(5.) In boiling the latter with a solution of caustic soda, benzoate of soda is formed, from which benzoic acid is precipitated by hydrochloric acid.

This is, in short, the process as followed by John Castelhay, of Paris, and of which Menier, the Secretary of Class 44 of the International Exhibition in Paris, says that it is the most important discovery made in technical chemistry since the London Exhibition of 1862.

CARBOLIC OR PHENIC ACID AND ITS PROPERTIES.*

By Dr. F. CRACE CALVERT, F.R.S. &c.

GENTLEMEN,—I have readily accepted the friendly invitation of your illustrious president, M. Dumas, to submit to your notice some facts relative to carbolic acid. But before doing so, allow me to express publicly the feelings of gratitude which I owe to France for having opened to me the way to the profession which I pursue with such pleasure. In truth, it is to the sympathy of scientific men of this country, to the friendly assistance of one of your scientific celebrities, M. Chevreul, and to the liberality of your institutions, that I owe the knowledge I have acquired, the elements of which I gained at the Gobelins and at the Museum of Natural History, during the stay I made there. After these remarks I will proceed with the subject of my lecture.

No doubt most persons present are aware that when coals are submitted to the action of a dull red heat, in a retort, products are obtained which may be grouped into four classes.

1. Gaseous products, commonly called coal gas, and which are now employed in so general a manner as means of illumination, sources of heat, and motive power.

2. Water, containing ammonia and ammoniacal salts, substances which chemistry purifies, modifies, and which are then utilised in agriculture, manufactures, and medicine.

3. There distils with the above products a black, sticky substance, of an unpleasant odour, called tar.

4. There remains in the retort a solid, porous body, which is known to us all as coke.

When the above-mentioned product called tar is submitted to distillation, water first comes over, then there distil jointly with this fluid liquid carburetted hydrogens, which, being lighter, float on it and are therefore called light oils of tar; and, lastly, compounds heavier than water are collected, which bear the name of heavy oils.

It is these heavy oils which were the first tar products utilised in manufacture. Their consumption made such rapid progress in England, that special manufactories were established for their preparation, and these works were, for a long period, the only ones in which tar products were produced. Most of them were established between 1837 and 1847, for the production chiefly of coal naphtha, used for many purposes, and heavy oils, employed for the preservation of railway sleepers, by a process discovered by Mr. John Bethell, by means of which they are preserved twelve or fifteen years; whilst without it they decay after three or four years. I have much pleasure whilst on this subject, in calling your attention to a very remarkable and very complete work upon the creosoting of wood, by M. Forestier, chief engineer of the department of

La Vendée, assisted by M. Marin. These gentlemen have made numerous experiments, the result of which is that wood thus treated is preserved from decay in water as well as under ground, and, what is important, wood is no longer destroyed by that very destructive insect the *teredo*.

Lastly, there remains in the still (after the heavy oils and some semi-solid substances have distilled off) a product which is fluid at the high temperature at which this operation is conducted, but which, when exposed to the natural temperature of the atmosphere, becomes hard and brittle, and is known under the name of pitch. This product, as you are aware, is largely employed in Paris under the name of asphalt, bitumen, &c., to make the foot pavements and public walks, as well as for the manufacture of a sort of concrete, called in England patent fuel.

After this rapid sketch of the products given off during the distillation of coal and tar, allow me to call your attention to *carbolic* or *phenic acid*, also called carbolic or phenic alcohol; in fact the latter is the most appropriate name for this substance, as its properties are not those of an acid, but that of an alcohol.

It is now twenty years since Laurent, the eminent chemist, first pointed out an easy method of extracting carbolic acid from coal tar. It consisted in submitting the light oils to a fractional distillation, and then treating with a concentrated solution of potash those products which had distilled at a temperature between 160° and 200° , separating the alkaline solution from the hydrocarbons which floated on it, and then neutralising the alkali by an acid which liberated the carbolic acid.

Such was Laurent's method of preparing carbolic or phenic acid, but pure carbolic acid was only there in a very small proportion; it was, in fact, a mixture composed chiefly of different liquids similar in properties and composition to carbolic acid, and, though Laurent succeeded in obtaining solid carbolic acid, still the process devised by him was too expensive to answer on a manufacturing scale; and, besides, his method of operating was too complicated.

In 1847, Mansfield, and towards 1856, M. Bobœuf, made known processes which, in fact, were only a modification of Laurent's, for they consisted principally in employing caustic soda instead of potash, and in treating the whole of the light oils instead of a special portion of them, as Laurent had done; still, by these processes, a very impure acid was obtained, from which it was very difficult, as experience has shown us, to extract pure carbolic acid; however, in a commercial point of view, the process of these gentlemen was a step in the right direction. This method was followed by Mr. Clifts in manufacturing some carbolic acid for me about the year 1847; and it was this impure acid which was employed by several chemists who, like myself, studied the properties of this substance, and who were endeavouring to apply it usefully; and I succeeded at about that time in applying it to the production of picric acid, or in preventing the transformation of tannic acid into gallic acid, in tanning substances, or, finally, in the preservation of subjects for the dissecting-room. M. Bobœuf also made use of it in preserving organic bodies from putrefaction, a property which has received of late very important applications.

In 1859, M. Marnas, of the firm of Guinon, Marnas, and Bonnet, of Lyons, came to Manchester, and asked me to furnish him with a purer carbolic acid than had been as yet manufactured. He showed me a white and crystalline product, which he gave as a specimen. It was then necessary to make new experiments, and we (F. C. Calvert and Co.) discovered that the best mode of preparation was not by treating light or heavy oils of tar with concentrated alkalis, but, on the contrary, by treating the impure benzines of commerce or naphthas with weak alkaline solutions. By this means a semi-fluid, blackish product was obtained, a little heavier than water, of a density of 1.06 , and which contained 50 per cent of real carbolic acid, which acid we managed to separate in part by careful

* Lecture before the Society for the Encouragement of National Industry in France.

distillation; and it was this product which was employed by Messrs. Guinon, Marnas, and Bonnet, and others, till 1861, for the manufacture of colours derived from carboic acid. At this period the colours obtained from aniline were so fine and brilliant that, to keep up a comparison with them, it was necessary to improve those derived from carboic acid. To effect this it was necessary to improve the quality of the carboic acid then manufactured, and, after some trials, we produced carboic acid in white detached crystals, melting at between 26° and 27°; and this is the product which is now generally employed in commerce and industry, as witness the specimens which are to be seen at the present Universal Exhibition. In 1863 this relative purity was insufficient, and the same firm which had required the improvements which I have before named asked us to try and make it still purer. We again set to work, and produced commercially Laurent's phenic alcohol or carboic acid; that is to say, a substance melting at 34° C., and boiling exactly at 186°. This became a very important commercial product for us, and we delivered large quantities monthly.

From this time I made many efforts to draw the attention of the medical profession to the really remarkable therapeutic properties of carboic acid, but the tarry and sulphuretted odour which it still possessed was a serious obstacle to its application. I soon succeeded in overcoming this difficulty, and towards the end of the year 1864 our firm was in a position to deliver, in considerable quantities, carboic acid deprived of sulphuretted compounds, and therefore fit for all medicinal uses. But I am glad to say that the series of improvements in the manufacture of pure carboic acid, or phenic alcohol, did not stop there, for towards the end of last year I discovered a process which now enables me to show you a product completely deprived of all disagreeable odour and tarry flavour, and, in fact, as pure, though extracted from tar, as if it had been produced artificially by the help of the reactions recently discovered by Messrs. Wurtz and Kékulé, based upon the direct transformation of benzine into carboic acid, or by the well-known changes by which it may be obtained from salicylic acid or nitro-benzoic. This new phenic or carboic acid is distinguished from Laurent's in being soluble in 20 parts of water, whereas the latter requires 33. It is fusible at 41°, instead of 34°, and boils at 182°, instead of 186°, but it gives, like Laurent's, the blue colour described by M. Berthelot when mixed with ammonia, and to the solution is added a small quantity of a hypochlorite; the same effect is also produced when you expose to the vapours of hydrochloric acid a chip of deal soaked in this pure carboic acid.

It was supposed that, as Laurent's phenic acid had a constant boiling and crystallisation point, it was a pure and definite substance. Now, the production of our new acid shows it is nothing of the kind, the product of Laurent being only a combination of our pure carboic acid and a liquid homologue; for when to the acid of Laurent is added a certain proportion of water, and the mixture is exposed to a temperature of 4° C., it deposits a crystalline substance in large octahedrons; which is a hydrate of carboic or phenic alcohol, that is to say, carboic acid combined with an equivalent of water of crystallisation. This fact is important in a chemico-theoretical point of view, for it exhibits the only example known of an alcohol which, combining with water, forms a crystallised hydrate. By removing from this hydrate the equivalent of water which it contains, carboic or phenic acid is obtained in its purest state.

(To be continued.)

Faraday as a Discoverer.—Under this title Messrs. Longman and Co. announce a memoir of the late Professor Faraday, by Dr. Tyndall. It is to be in one volume, crown, 8vo, and will be published in January.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

December 5th, 1867.

DR. WARREN DE LA RUE, F.R.S. President, in the Chair.

THE minutes of the previous meeting were read and confirmed, the donations to the library announced, and the notice convening a special or general meeting of members for the consideration of a proposed alteration of the first by-law was again read. The President explained the nature of the amendments which it was contemplated to make, and, after taking the vote by show of hands, declared them to have been unanimously agreed to. By a second resolution it was decided that they should take effect from the first meeting in the new year. The by-law as amended stands thus:—

"Every candidate for admission into the Society shall be proposed according to a form of recommendation (No. I., Appendix) subscribed by five Fellows of the Society, to three, at least, of whom he should be personally known, and such certificate shall be read and suspended in the Society's rooms, or place of meeting, for three ordinary meetings."

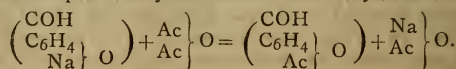
A verbal modification in the heading of the form of recommendation was likewise acceded to.

The Secretary then read for the first time the names of the following candidates for admission into the Society, viz., Captain Alexander Walker, Royal Artillery, Bengal Presidency; Gilbert W. Child, M.D., St. Giles, Oxford; Mr. Edward Chapman, Lecturer in Natural Science at Merton College, Oxford (Frewen Hall, Oxford); W. G. Mason, Esq., near York; and Peter Greiss, Burton-on-Trent.

For the second time were read the names of Alfred E. Fletcher, Inspector of Alkali Works, Johnston, near Prescott; and William Frank Smith, M.D., Lond., Lecturer at the Sheffield School of Medicine, Glossop Road, Sheffield.

The names of the undermentioned candidates were read for the third time, and from the results of the ballot all were declared to have been duly elected, viz., Thomas Hall, B.A., Lond., Lecturer on Chemistry and Natural Philosophy at the City of London School; Charles Walter Maybury, Teacher of Chemistry, 90, King Street, Manchester; George Lunge, Ph.D. (Breslau), 10, Albert Terrace, South Shields; Facundo J. R. Carulla, Chemist to the Atlas Steel and Iron Works, 59, Gell Street, Sheffield; Charles Meymott Tidy, M.B., The Hollies, Cambridge Heath, Hackney; Augustus A. Wood, Cheap-side; Alfred Coleman, Plough Court, Lombard Street; Walter W. Fiddes, Sothornhay, Clifton; Robert R. Tatlock, Kyles of Bute; Philipson Beale, Barrister-at-law, Stone Buildings; and Alexander Crum Brown, M.D., D.Sc., 4, Rillbank Terrace, Edinburgh.

Mr. W. H. Perkin read a paper "*On the Artificial Production of Coumaric, and Formation of its Homologies.*" Referring to the hydride of aceto-salicyl as a body isomeric with coumaric acid, and to his failure in obtaining this body by the method of Cahours, the author attempted its preparation by the action of acetic anhydride upon the hydride of sodium-salicyl, thus,



Instead, however, of getting at once the expected product, a substance was obtained which differed from it by

containing $C_6H_6O_2$, i.e., deficient by the elements of one atom of water. This formula coincides with that of coumarine, with which, indeed, it proves to be absolutely identical. Its odour resembles that of the Tonquin bean, and the fusion and boiling-points are the same. The author has exactly determined the physical characters of coumarine, both from natural and artificial sources, and calls in question the accuracy of some of the recorded observations.

By employing the anhydrides of other acid-radicals, Mr. Perkin obtains a series of homologous coumarines, which are fully described in the paper; particularly, he has formed a crystalline butyric coumarine, $C_{11}H_{10}O_2$, fusing at $72-73^\circ C.$, and submitted it to the action of alkalis, bromine, &c. The valeric coumarine was likewise prepared, and an ingenious method of purification resorted to for the purpose of procuring a sample fit for analysis. Its formula is $C_{12}H_{12}O_2$, and fusion point $56^\circ C.$

The author concludes his paper with a survey of the probable constitution of this class of bodies, and conceives that the reaction quoted above actually expresses the first stage of the interchange involved in the production of the coumarines, since by very careful working he procured in one instance some of the hydride of acetosalicyl which he found to possess the properties both of an aldehyde and acetate; but he promises to give shortly a fuller account of this substance.

In proposing a vote of thanks to Mr. Perkin, reference was made, both by the President and by Dr. A. W. Hofmann, to the original research conducted in the laboratory of the Royal Chemistry by Dr. Bleibtreu, who, in 1846, established the identity of coumarine of the Tonquin bean with the aromatic principle contained in the German "Maiwein," which is prepared from the little forest plant known as woodruff (*asperula odorata*).

Professor A. H. Church then made a statement respecting the nature of the red (or crimson) colouring matter which is commonly found on the primary and secondary pinion feathers of the wings of the Cape Lory (*Turacus albocristatus*). The author's attention was called to this matter by the editor of the *Field* newspaper, and he had since had opportunities of studying the habits and experimenting upon the feathers of some little birds reared in this country by a celebrated ornithologist. They were popularly supposed to be stained with blood, since it has been noticed that some of the colour is washed out by the rain. The colouring matter is, however, only very slightly soluble in pure water; but if a trace of alkali be added, it then freely dissolves out, forming a magnificent crimson solution. Hydrochloric or other mineral acid added to this liquid at once precipitates the red substance [Experiment shown]. The remarkable feature of the whole case was the fact that analysis proved the existence of copper, apparently in some organic form of combination. [This important observation was exhibited at the meeting by showing with the aid of a platinum wire the bright green tinge imparted to a gas jet when a small quantity of the substance, moistened with hydrochloric acid, was held in the flame of a Bunsen burner.] The web of the feather and parts not coloured did not contain a trace of copper, and only sixteen feathers in all showed this peculiar phenomenon. The total amount of colouring matter was therefore very small, only 1.6 grains being procurable from each bird at the cost of half a guinea. The author's experiments were, for the present, interrupted for want of material; but he was satisfied that the organic body in combination with the copper contained nitrogen, with carbon, of course, and, he believed, sulphur. The substance may be dissolved in concentrated sulphuric acid, and reprecipitated unaltered upon the addition of water. None of the copper is thus separated; but if nitric acid be used the organic elements are destroyed, and then copper may be detected even in the diluted solution. [A bird and several plumes were exhibited, besides a small quantity of the colouring matter in a separate form.]

The PRESIDENT remarked upon the singular character and mode of occurrence of Mr. Church's new substance. For his own part he was not aware of the existence of any crimson dye containing copper.

In answer to Dr. Gladstone, the author stated that he had made an optical examination of the substance, and compared its absorption spectrum with that of arterial blood. There was a general similarity so far as regards the fact of their both showing two bands; but in the present instance they were nearer to the yellow end of the spectrum, and the darker band almost coincided with the fixed line D. Professor Church further stated that he failed in detecting copper in the red plumage of humming birds.

A "Note on the Preparation of Urea," by Mr. JOHN WILLIAMS, was next read. The author proceeds, in the first instance, to prepare cyanate of potassium by fusion of the cyanide (best commercial quality, containing 90 per cent) with red oxide of lead, keeping the temperature as low as possible. This product is dissolved in cold water, mixed with nitrate of barium to precipitate the carbonate which it usually contains, then thrown down as lead-salt by adding a solution of the nitrate. The cyanate of lead is easily purified by washing, and is then dried at a gentle heat. For the preparation of artificial urea equivalent amounts of sulphate of ammonia and cyanate of lead are digested together in warm water, the insoluble sulphate filtered off, and the solution when evaporated yields a product of unusually good quality, and of larger amount than by the ordinary plan. Mr. Williams finds that the process is applicable to the preparation of the compound-ureas, using the corresponding sulphate instead of the simple ammonia-salt.

Dr. A. W. HOFMANN, who was welcomed in a most enthusiastic manner, then gave an account of his recent discovery of the "methylic aldehyde," and, with Mr. M'Leod's assistance, performed an experiment by means of which the method of production of this interesting compound was conclusively demonstrated. The main facts of Dr. Hofmann's research have been already communicated to our readers in an article specially devoted to their consideration last week, and it is now only necessary to report the latest statements of the eminent author regarding its constitution.

Dr. HOFMANN remarked that "a more minute examination of methylic aldehyde and its derivatives remains still to be made. It will be absolutely necessary to isolate the oxygen term, and to determine its vapour density, in order to ascertain its molecular weight. If we remember the facility with which the aldehydes are polymerised, the question presents itself whether the aldehyde formed by the slow combustion of methylic alcohol is represented by the formula—



or a multiple thereof. A similar remark applies to the sulphur derivative. It deserves, moreover, to be mentioned that a compound isomeric with methylic aldehyde, the dioxy-methylene ($C_2H_4O_2$) of Boutlerow, is known already; also that a sulphur compound of the formula—



has been obtained by M. Aimé Girard, who observed that bisulphide of carbon is reduced by the action of nascent hydrogen with disengagement of sulphuretted hydrogen."

Dr. HOFMANN then proceeded to describe the leading features of another research, which will be printed in *extenso* in our columns, and which has resulted in the production of "A New Series of Bodies Homologous to Hydrocyanic Acid." The action of alcoholic ammonia upon chloroform, in the presence of a fixed alkali, was shown experimentally to give rise to the formation of a cyanide (afterwards indicated by the Prussian blue test); and in like manner a mixture of aniline, chloroform, and alcoholic potash furnished an aromatic oil of powerful cyanic odour which the author believes to be the cyanide of phenyl



This compound differs in every respect from Fehling's benzonitrile, with which it is isomeric. A great number of similar reactions were indicated by the speaker, and a general principle enunciated which will take a long time fully to exhaust. Already the author has made good progress towards examining the action of chloroform upon the diamines.

Professor ABEL, who at this stage of the proceedings occupied the chair, said that at so late an hour it would be impossible to enter upon a discussion of Dr. Hofmann's interesting results. He would, however, invite the members to give expression to the formal proposal which he had now the pleasure of moving. [The vote of thanks was received with loud acclamation.]

Dr. Hofmann, in acknowledging the kind welcome with which he had been received, testified to the pleasure he felt in the circumstance that a meeting of the Chemical Society happened to coincide with the period of his short visit to London. He was delighted to meet at once so many friends, and could assure them that he felt so greatly the want of similar encouragement in Berlin that within the last few weeks he and his colleagues had inaugurated a Chemical Society in the Prussian capital, founded on the model of the parent Society in London—(Applause).

The SECRETARY announced the title of a paper to be read at the next meeting, 19th instant, viz:—"Analogies in the Cooling of Water and Bismuth," by Mr. Alfred Tribe. The meeting in January (16th proximo) would be devoted to a lecture "On Water Analysis," by Dr. E. Frankland; and Mr. Siemens had promised to give a lecture, of which the date was not yet fixed, "On the Production of Steel direct from the Ore."

The meeting, at which there was a very full attendance, both of Fellows and visitors, was then adjourned.

PHARMACEUTICAL SOCIETY.

Wednesday, December 4, 1867.

T. H. HILLS, Esq., Vice-President, in the Chair.

AFTER the minutes of the preceding meeting had been read and confirmed, and the thanks of the meeting given for several donations to the library and museum,

Dr. ATTFIELD referred to the paper in the November number of the *Pharmaceutical Journal*, "On a New Kind of Kamala," which was obliged to stand over from their last meeting. Since then he had seen Prof. Anderson, the discoverer of rotteline, and had referred to the great difference between the amount of impurity he had found in the samples he had examined and that of Foibourg, who had found about 28 per cent of impurity, while the only impurity Anderson had found was $\frac{3}{4}$ per cent of ash. Dr. Anderson had worked upon a sample collected for him with great care by Dr. Cleghorn, while it was possible that Foibourg had worked upon a very impure article.

Mr. D. HANBURY, F.R.S., thought the explanation of Dr. Anderson scarcely satisfactory. He had written to Dr. Anderson asking him for a specimen of the kamala, for he thought Anderson might have been working on the new kind; but on examination he found it to be the old kind. Foibourg had tried every possible way, and he found it was not highly crystalline, and only in small quantities.

Dr. ATTFIELD said that Dr. Anderson had found vegetable as well as mineral impurities.

Mr. HANBURY had found no vegetable substances, excepting remnants of the capsule, or portions of the leaf. The impurities were ferruginous earth and siliceous particles.

Mr. HOWDEN then read an interesting paper "On the Norwegian (Lofoden) Cod Fisheries." The author commenced by referring to the codfish migrating at certain periods of the year, which he thought was due to the in-

stinct of propagation. He then described the way in which the fish were caught, and the livers preserved till the oil could be separated, giving full particulars respecting the different modes adopted by the fishermen and others.

Mr. HOWDEN also exhibited four samples of oil, the finest being the genuine Lofoden oil imported by Mr. Moller, and the fourth sample a very dark brown oil with a strong disagreeable odour. The livers from which this sample was obtained had been boiled over an open fire for 12 hours, showing the pernicious influence of a strong heat in the separation of the oil.

The CHAIRMAN thanked Mr. Howden for the valuable paper, and referred to the oil obtained in England. He knew some very fine oil was obtained, and in considerable quantities, from livers weighing 1lb. and 2lbs. each.

A MEMBER enquired how it was that the Norwegian Pharmacopœia allowed the use of several species.

Mr. HOWDEN said that at the present time a new edition of the Norwegian Pharmacopœia was being prepared, which would be similar to the British Pharmacopœia.

Mr. INCE alluded to the various statements which have been made with reference to the cod fisheries. No two authors were at all agreed. He thought the paper read by Mr. Howden very valuable, as it gave the opinions of gentlemen direct from the spot. He then referred to the geographical position of Lofoden, and the different ways of spelling the word Lofoden. Only a few days since he was reading two pamphlets, both written by persons from the spot, and yet there was a great difference between them; and there had, he believed, been four different articles in the *Pharmaceutical Journal* all expressing different opinions.

Professor REDWOOD, in thanking Mr. Howden for his very practical paper, said he believed there were great advantages attaching to the preparation of the oil in Norway, arising from the fact that they had greater facilities for obtaining the livers fresh and exposing them to a low temperature for the separation of the stearine from the oleine; but in England we could obtain very good oil, its intrinsic qualities being equal to Newfoundland oil. Moller's oil was of excellent quality; but there were different opinions as to which of the three kinds of oil were therapeutically the best. On exposure to the air it absorbed oxygen, and the difference between the light and the dark showed the degree of oxidation which had taken place. It probably undergoes a process of oxidation in the system, for persons in the habit of taking cod-liver oil often acquire an odour which the pure oil possesses after long exposure to the air.

Mr. H. B. BRADY had prepared a paper entitled "Supplementary Remarks on the Preparation of Medicated Pessaries and Suppositories;" but as the time had expired, he postponed the reading of the paper, and only made a few observations on some specimens of moulds and suppositories, &c., which he had laid on the table. In speaking of pessaries, Mr. Brady said there was an objection to their being too large. He thought one dram would be found a much better size than two drams.

The CHAIRMAN stated that as the 1st of January would be the first Wednesday in the month there would be no Pharmaceutical meeting till the 5th of February. He concluded by wishing them all a merry Christmas and a prosperous New Year.

A Well-deserved Honour.—The "International Societies for Aid to the Wounded in Time of War" have awarded to Mr. Condry, of Battersea, their medal, in recognition of the importance to military surgery of his discovery of the disinfecting properties of the alkaline permanganates, and the great sanitary value of Condry's fluid, as proved by the experience of the Prussian army surgeons during the late Bohemian war.—*Lancet*.

MANCHESTER LITERARY AND PHILOSOPHICAL
SOCIETY.

PHYSICAL AND MATHEMATICAL SECTION.

November 7th, 1867.

ROBERT WORTHINGTON, F.R.A.S., President of the Section
in the Chair.

"Note on the Colour of the Moon during Eclipses," by
A. BROTHERS, F.R.A.S., &c.

On the night of October 4th, 1865, there was a partial eclipse of the moon, when about one-third of the disc was obscured. My time and attention on this occasion were chiefly directed to some photographic experiments, and it will be remembered I then obtained pictures of the eclipse at short intervals, from the commencement to the end. At about the greatest phase I looked at the moon through the telescope with an eye-piece of low power, for the purpose of noticing whether the eclipsed portion showed colour, and at once saw that the part of the moon most deeply within the shadow was of a decided copper colour, such as I had seen some years previously during a total eclipse of the moon.

The eclipse which occurred on the night of the 13th September last, was rather more favourable for detecting the presence of colour, as seven-tenths of the moon were covered by the earth's shadow; the weather being clear many persons have recorded their observations, and as the colour of the moon is one of the chief features of a lunar eclipse, this point attracted considerable attention.

Mr. Browning says, in a letter which appeared in the "Astronomical Register"—"I looked most carefully for colour both with the 10½ silvered glass reflector furnished with an achromatic eye-piece of very low power, and also with a five-feet refractor; with neither could I detect a trace."

Mr. Slack, who was also observing with a silvered glass reflector, and in the same locality as Mr. Browning, says,—"After twelve, the eclipsed limb grew noticeably redder, the red coppery tint chiefly affected the lower parts of the obscured limb, but was visible further in, gradually blending with the inky tints presented by the umbra at its advancing edge."—(*Int. Obs.*, October.)

Mr. Weston, observing at Landsdown, near Bath, says,—"The prevailing colours were red-bluish and grey, and grey: the redness increased towards the darkened edge of the moon."—(*Monthly Not.*, 9, xxvii.)

Many other observers speak of the presence of colour, but on the other hand a few say they did not notice any, the eclipsed portion of the moon merely having a darkened appearance.

On this occasion I did not make any photographs, as I could not expect results materially differing from the last, and I gave my whole attention to observing the progress of the eclipse through the telescope, which is a refractor of five inches aperture. As to the question of the presence of colour, I can most distinctly say that colour gave the moon a very beautiful appearance, and it seemed to me the most interesting feature of the eclipse. The beauty of the moon's surface appeared to increase as the penumbral shadows stole over its surface; and until the shadow itself was considerably advanced, all the details of the lunar surface could be distinctly made out, and during the whole period of the eclipse some of the brighter points of light within the shadow continued visible, as did also the entire disc with many of the details of light and shade. The colour of the eclipsed limb was of a coppery hue, much brighter towards the part most deeply within the shadow. The part of the moon not eclipsed was of a beautiful bluish-grey colour.

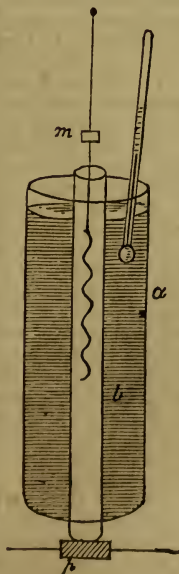
That the appearance of colour cannot be caused by the telescope or by peculiarities in the eyes of the observers is, I think, proved by the fact, that the same colours are seen whether refractors or reflectors, either of metal or silvered glass, be used; and, as the majority of observers see colour, the eyes of those who remark the absence of it are perhaps temporarily afflicted with colour blindness;—the bright light from the uneclipsed portion of the moon may be sufficient to produce this in some persons. If an observer, after looking at the moon through the telescope, attempts to look at objects while the other eye remains closed, it will be found that until the retina has recovered from the excess of light every thing will appear misty—in fact, the eye is partially blinded, and it may be that some eyes are sufficiently sensitive to be affected by the diminished lustre of the moon, and may thus be prevented seeing colour, which there can be no doubt the lunar surface presents during an eclipse.

Some observers have remarked on the difficulty of detecting the first appearance of the shadow, and although the exact time is known, the real shadow is not seen until many seconds or perhaps minutes after the predicted time. In the present instance, I watched very carefully for the first appearance of the shadow, and, having previously ascertained the error of my watch, I took my position at the telescope, at the same time I requested a friend to take particular notice of the time at the moment I saw the shadow. The result thus obtained was within twenty seconds of the time given in the "Nautical Almanac," clearly showing that under favourable conditions, and, if the attention be given carefully to the subject, the real shadow may be detected very near the predicted time.

Ordinary Meeting, November 26th, 1867,

EDWARD SCHUNCK, F.R.S., &c., President, in the Chair.

"On a Thermometer unaffected by Radiation," by
DR. J. P. JOULE, F.R.S., &c.



In the annexed figure *a* is a copper tube about one foot long, and has a tube open at both ends in the centre. Water is poured into the space between the two tubes. In the centre tube there is a spiral of fine wire suspended by a filament of silk, and having a mirror at *m*. There is a lid at *p* which can be removed at pleasure from the lower end of the tube. When *p* is situated as in the figure, there can be no draught, and consequently the spiral with its mirror is at zero of the scale. But when *p* is removed, there is a current of air which turns the spiral, if the air in the tube has a different temperature from that of the outside atmosphere. In my apparatus, one degree F. produces an entire twist of the filament. I find that the temperature in the tube is generally warmer than in the outside atmosphere of a room, which must be owing to the conversion of light and other radiations into heat on coming into contact with the copper tube. I have tried the apparatus in the open air on a still day, with the same result. Of course when there is wind the effect is masked, but I feel confident that by increasing the length of the tube, making it 30 feet for instance, and using certain precautions, this difficulty may be overcome.

NOTICES OF BOOKS.

Micro-Chemistry of Poisons, including their Physiological, Pathological and Legal Relations: Adapted to the use of the Medical Jurist, Physician, and General Chemist. By THEO. G. WORMLEY, M.D., Professor of Chemistry and Toxicology in Starling Medical College, and of Natural Sciences in Capital University, Columbus, Ohio. With Seventy-eight Illustrations upon Steel. New York: 1867. Baillière Bros.

THE chief objects of Professor Wormley's book are stated by the author to be "to indicate the limit of the reactions of the different tests which have heretofore been proposed, as also of those now added, for the detection of the principal poisons, and to point out the fallacies attending the reaction of each; and, also, to apply the microscope, whenever practicable, in determining the nature of the different precipitates, sublimate, &c., and to illustrate these, whenever of practical utility, by drawings."

The plan of the book is therefore peculiar. It does not affect to be a complete treatise on toxicology, for the poisons described are few in number and are principally those which can be readily detected by chemical methods. The list is indeed so circumscribed that we look in vain for many highly important poisons. There is no mention of colchicum, cantharides, or croton oil: the poisonous gases are entirely omitted, and this is even the case with some substances, such as nitrobenzol,* cocculus indicus and the salts of barium, which can be detected by purely chemical methods. We cannot but regard these omissions as an abridgement of the utility of a work which is evidently intended rather for the professional man than the student.

Within its own limits, however, the book is excellent, and we fully admit that for common purposes the limits are quite wide enough. It is divided into two parts, the first devoted to inorganic, and the second to vegetable, poisons. The first part includes the alkalies, the mineral acids, oxalic and hydrocyanic acids (placed here for convenience), phosphorus, antimony, arsenic, mercury, lead, copper, and zinc. The second part is entirely confined to the poisonous alkaloids and the substances from which they are obtained. The following is the order of the chapters in which they are treated. 1. The volatile alkaloids of tobacco and hemlock. 2. The constituents of opium. 3. Nux vomica. 4. Monk's-hood, deadly nightshade, and stramonium (aconitine, atropine, and daturine, the latter of which is justly regarded as identical with atropine). 5. Elebore and the different species of solanus (veratrine, solanine). It will perhaps give the best idea of the mode in which each poison is described if we select a single case, that of arsenic. First we find an account of the leading properties of arsenic and its principal compounds. Then follows a detailed account of arsenious acid, the symptoms produced by it, the quantity required to cause death, and the mode of treatment proper in cases of poisoning by it. Under this last head some curious experiments are quoted on the action of ferric hydrate as an antidote. The author of these experiments, Dr. Wm. Watt, found that dogs of average size were invariably killed by doses of from 3 to 6 grains of the acid. He then treated twelve more dogs with doses varying from 3 to 8 grains and followed them up—in some instances immediately, in others when symptoms of poisoning commenced—with doses consisting of two tablespoonfuls of the moist hydrate. In every case the dog recovered without exhibiting severe symptoms. "In another case six grains of the poison in solution were mixed with about fifteen parts by weight of the antidote, and the mixture, after

standing twenty minutes, given to a dog; no appreciable effect whatever was observed, although the animal was closely watched for many hours."

Next we come to the chemical properties of the acid. Original experiments are given on the solubility of the acid in water, which appear to indicate that the solubility both of the opaque and crystalline variety depends greatly upon the conditions under which the experiment has been made. A long and elaborate account of the special tests for the acid next follows, and here we notice one of the most valuable characteristics of the work. After the description of each important test, original experiments are given, showing the reaction obtainable with definite quantities of the materials, and thus affording a good and reliable measure of the delicacy of the test. We will give as an instance the experiments upon that form of Marsh's test in which the gas is decomposed in a tube by heat.

"1. 1-2,500th grain of arsenious acid in one hundred grains of liquid, or one part of the acid in the presence of 250,000 parts of fluid, yields in a very little time a very fine deposit, the inner portion of which has a brown colour, while the outer part has a bright metallic lustre.

"2. 1-5,000th grain, under a dilution of 500,000 parts of liquid, yields much the same results as 1.

"3. 1-10,000th grain, under a dilution of 1,000,000, yields a quite good deposit.

"4. 1-25,000th grain, under a dilution of 2,500,000, yields after some minutes, a very satisfactory deposit.

"5. 1-50,000th grain, in the presence of 5,000,000 parts of liquid, yields, after several minutes, a very distinct stain, the outer part of which has a dark metallic appearance, and the inner a brownish colour."

The author remarks that although Marsh's test will reveal the presence of arsenic in a greater state of dilution, Reinsch's test is really more delicate, because so much smaller a quantity can be employed. Used with the nicest care the latter test is capable of giving distinct evidence of the presence of 1-100,000th of a grain of the poison.

It is right to remark, in connection with Marsh's test, that the author has omitted to point out one of the chief difficulties attendant upon its use, namely, the frothing which, as every chemist knows, is generally produced in the presence of organic matter. He even directs us to estimate "the quantity of arsenious acid present in an organic liquid," . . . "by introducing the solution into an active Marsh's apparatus, containing just sufficient sulphuric acid to evolve a very *slow* stream of gas," and to conduct the evolved gas into dilute nitrate of silver. The usual methods for the separation of the poison from organic matter are given, but they do not seem to prevent any points of novelty. Lastly, there is a useful paragraph entitled "Failure to Detect the Poison," in which the time required for its elimination is considered.

The other poisons are discussed in a manner similar to the above, and a good many useful and perhaps a few useless tests are added to those already employed; but our limits prevent us from giving further extracts. The account of the strychnine tests, their fallacies, and the substances which interfere with them, is particularly good. The substance most likely to be mistaken for strychnine appears to be woorara, the sulphuric acid solution of which gives a violet colour with potassic bichromate; but it may be distinguished by the circumstance that it gives a red or purple colour with sulphuric acid alone, whereas strychnine remains colourless.

We have not yet alluded to the chief characteristic of the work—the characteristic by which its name is justified. It is accompanied by an atlas of microscopic plates in illustration of the forms assumed by the principal precipitates and sublimate obtained in toxicological analysis. Not only have we the crystalline forms of the alkaloids and their compounds presented to us, but also those of many crystalline mineral precipitates, such as the potassic and sodic platino-chlorides, and even of some which, like baric and plumbic sulphates, and argentic arsenite and cyanide,

* A slight allusion to nitrobenzol occurs in page 561, where the author refers to Vol. v. of the CHEMICAL NEWS, in which Dr. Letheby's observations are recorded.

are not generally recognised as having a crystalline character. These illustrations are executed on steel, and are marvellously beautiful, and, as far as we are able to judge, equally accurate. It is pleasant to learn from the preface that science owes them to the skilful hand of a lady. Professor Wormley may well dedicate the book to his wife, for it owes a very large portion of its usefulness and importance to her work.

It would be hardly fair to the publishers to conclude without remarking that the style in which the book is got up is exceedingly good, that type, paper, and binding are all first-rate, and might almost have excused the publication of a bad book.

The Bible and Science. An Address delivered at the Church Congress, Wolverhampton, Oct. 3, 1867. By WILLIAM ALLEN MILLER, M.D., LL.D., Treas. and V.P.R.S., Professor of Chemistry in King's College, London.

THE old prejudice which existed in the minds of many good persons against the cultivation of science, that it tends to promote scepticism in religion, has not yet died out, and we are bound to admit that the published opinions of some scientific men have given it new life. Of course this is very unreasonable, for it would be as unwise to denounce language because it may be perverted, or money because it may be spent on unworthy objects, as to denounce science because some of its professors are sceptics.

Religion has become so much a matter of dogma, of sect, of party, of antagonistic opinions on comparatively unimportant matters, of literal interpretation, and so forth, that Christianity is liable to be lost under the multitude of its coverings.

Those who regard religion as too sacred for everyday use, look with a kind of horror on the proposition that science is as much the work of revelation, as the religion of faith. The same power that permitted or inspired the Prophets and Apostles of old to reveal the Divine will to man, has permitted and permits man to discover some of the hidden mysteries of the universe. It is indisputable that the laws by which material things are governed have the same Lawgiver as those which regulate the spiritual world. The law of inverse squares is not more wonderful or more easy to grasp in its origin, permanence, and constancy, than the scheme of man's redemption and future happiness; only in the one case men can see and appreciate the induction which led to the discovery of the law, while in the other the faith which converts the doctrine of his redemption into a living vital truth is not so easily commanded.

From time to time we get such evidence as is afforded by the pamphlet before us, that a man may occupy a high position in the scientific world, and yet be a good Christian. Such evidence as this is all the more valuable as coming from a layman; and although the essay was read at a Church congress, and the author belongs to a College which requires all her officers to be members of the Church of England, yet there is nothing churchy or sectarian about it. This will make it acceptable to a large body of cultivated men, who, disgusted at the wranglings and contentions, strifes, and heart-burnings of sects, and the present disorganised state of opinion in the Church of England, turn away from every church, and are disposed to cultivate rationalism rather than religion.

We attach the greatest importance to the non-sectarian tone of this essay; because it helps forward the grand idea that a churchman, or the member of any sect, is not necessarily a Christian, and that a Christian is not necessarily a sectarian.

CORRESPONDENCE.

ELECTIONS AT THE CHEMICAL SOCIETY.

To the Editor of the Chemical News.

SIR,—As a member of the Committee whose report to the Council of the Chemical Society you published last week, and which has not been signed nor agreed to by me, I feel myself called on to enter a protest against the concluding sentence of that report. I was present at earlier meetings of the Committee, but not at the last meeting, nor at the meeting of Council which received the report. I have privately expressed to members of the Committee my disapproval of the last sentence of the report.

Having voted against the candidates whose rejection raised the question of the abrogation of the by-law, and being still of opinion that I and those gentlemen who voted with me were in the right in the course we took, I cannot submit to having the occasion used as an opportunity for tendering advice as to the line of action to be followed by the Society in the event of members making an improper use of the ballot box. More than that, I could not recommend such an alteration of the by-law as is mentioned in the report, even in the event of a section of the Fellows banding themselves together to exclude a desirable candidate.

It appears to me, moreover, that the Society is in far more danger of falling helplessly into the hands of an official clique than of being deprived of the fellowship of valuable candidates through the combined action of private members. For my own part, I look rather upon a radical change in the manner of appointing the Council of the Chemical Society as the desideratum.

It is a notorious fact that the annual meeting for the election of officers and Council is, as a rule, poorly attended, and that the new Council is, as a matter of fact, elected by the votes of the retiring Council, whose individual members vote for that purpose in the capacity of private Fellows.

This state of matters, which is partly indicative of apathy on the part of the Society at large, and partly a consequence of the scattered state of the 500 members, is styled in official language a proof of the great confidence of the Society in its officers.

I regard it as a sign that election by vote does not answer as a mode of appointing the Council. In truth, at the present moment, the Council is not really delegated by the Society at large, but owes its present composition to a kind of apostolical succession.

Two courses present themselves to my mind as calculated to remedy this evil. The one is to deprive the Council of its votes in the election of its successor. Relieved of this depressing circumstance, the Society at large might perhaps be induced to take part in the election of a Council. The other course is to have the Council chosen by lot out of the whole 500 Fellows of the Society. Unpromising though this latter plan appears at first sight, I am inclined to think it would not work badly, and it would certainly deliver the Society from the kind of apostolical rule which I regard as one of the worst evils with which a Society can be afflicted.—I am, &c.,

J. ALFRED WANKLYN.

London Institution, December 2, 1867.

LECTURE EXPERIMENTS.

To the Editor of the Chemical News.

SIR,—I should be glad to know if you would spare a column occasionally in your journal for an exchange of notes concerning lecture experiments. I am sure that to a large majority of the now numerous body of science

teachers such a column would be highly useful. As a rule the conditions of success are not stated in our text books when an experiment is described, and much time is lost in seeking them. Thus I have spent a considerable time in finding a neat and ready method of demonstrating the combustion of oxygen in hydrogen. No doubt all who have made the experiment have met with similar difficulties; but if there were a column such as I venture to suggest, the labours of one person would serve for all. As a contribution to such a column I would ask you to insert—

FLOATING SOAP BUBBLES IN CARBONIC ACID.

A vessel in which to hold the carbonic acid may conveniently and cheaply be made by getting five square pieces of glass—they should be at least 30 or 40 c. square,—then joining their edges by bibulous paper soaked in glue, so as to form a cubic shaped vessel. When the glue is dry a strip of cloth about two centimetres wide should be glued in the inside of the vessel, and lap over the edges, not only for protecting the ragged edges of the glass, but to prevent the bubbles from bursting. The carbonic acid used should be passed through a wash-bottle containing potassic carbonate, so as to free it from the vapour of hydrochloric acid, and then conducted into the cubic vessel until it is quite full. If a bubble now be blown with the glycerine and soap solution it may be floated easily on the carbonic acid. Should a draught carry it to the side of the vessel the strip of cloth will cause it to rebound again to the centre, and thus the bubble may float for many seconds, or even for a minute or two.—I am, &c.,
C. J. WOODWARD.

Middlesex Institute, Birmingham, December 11, 1867.

MISCELLANEOUS.

The late Professor M'Gauley.—We are requested to draw attention to the M'Gauley memorial fund (offices, 21, Cockspur Street, Charing Cross.) which is now being raised on behalf of the widow and family of the late Professor M'Gauley, Editor of the *Scientific Review*,—a man whose literary and scientific attainments made him much respected by all who knew him. As he had no opportunity of realising more than a bare sufficiency for his immediate wants, his wife and four children are unfortunately left utterly unprovided for, and a fund is now being raised for their relief.

Singular Explosion.—Under this head the *Times* gives the following account of the circumstances, as elicited at the inquest, under which a fatal accident took place during the preparation of hydrogen :—"Mr. Laurence, 9, Little George-street, Greenwich, said that he was a house painter and decorator, and that he was employed to make the lime-light to be used during the performance at the Greenwich theatre. On Saturday morning, the 16th ult., he went into the workshop at the back of his house, and while he was in the act of making it an explosion of hydrogen gas took place. He had placed some old nails and some scraps of iron in a large glass vessel, and he then poured three pints of water into the vessel. After that he poured some sulphuric acid into the jar. There were three pints of water in the vessel, and when he had poured three to six ounces of the acid into it an explosion took place, and he was covered from head to foot. He then heard loud shrieks, and upon rushing out of the workshop he found that two of his daughters had been injured. The deceased had her throat cut, and blood was rushing from the wound. He placed her in a cab, and she was taken to Guy's Hospital. Witness made the hydrogen gas every other day in a bag of three feet nine cubic inches. That lasted two nights. He had

studied chemistry for twenty-five years, and he believed that the cause of the explosion was the coldness of the preceding night acting upon an old solution of water, iron, and sulphuric acid that was in the glass jar at the time that he poured the fresh solution into it through a funnel. The old solution was crystallised. He was not injured." The explosion is peculiarly "singular," since as far as we can understand the circumstances as described by our contemporary, the explosion took place in one room while its effects were chiefly felt in another; and, moreover, no mention is made of any flame by which ignition could have been caused. If the vessel burst simply from an enormous pressure of gas, this could only have happened by the apertures being purposely tightly closed. We can scarcely imagine a man having "studied chemistry for twenty-five years" making hydrogen without using an acid funnel. If anything were wanted to complete the mystification, the explanation of the cause of the explosion, given by the student of twenty-five years' standing, is sufficient. The jury returned a verdict of "Accidental death," recommending with naïveté that there should be more caution used in future while hydrogen gas was being made; and the coroner finished by saying that "he did not think such a dangerous compound (!) ought to be made except in places properly allotted to it." This remarkable commentary shows that "Crownner's" Chemistry is as profound as "Crownner's" Law.

Edwards v. Norris.—In Chancery.—This case relates to the chemical works of the defendants at Sowerby-bridge, in the West Riding of Yorkshire. The bill prays "That the defendants, their agents, and workmen, may be restrained from discharging, or causing, or permitting to be discharged from their works at Sowerby-bridge, any vapour, or sulphuric acid, or sulphurous acid, or any other noxious or offensive gas, vapour, or substance, so as to occasion any nuisance or injury to the plaintiff's property called Pye Nest, or the property belonging to the plaintiff and his brother Joseph Priestly Edwards as tenants in common, or to the timber, or other shrubs or herbage on the same respectively." The second clause asks for an inquiry as to damage. Lord Romilly, in delivering judgment in the Rolls Court on December 4th, said—"A vast amount of evidence has been gone into on both sides to prove and disprove the case of the plaintiff. The burden of proof lies on the plaintiff, and after a very long and detailed examination of the evidence on both sides, I am of opinion that the plaintiff has failed in giving the proof which is necessary to induce me to give him a decree. The evidence is so voluminous and so varying, that I should only become obscure, and fail in showing the true grounds of my decision, if I were to attempt to state in detail what, in my opinion, each witness establishes, and in what parts his evidence falls short of the required proof. But I will state, generally, what I consider to be proved by the evidence, and the points in which I think the evidence is defective. I think it is clearly proved that vegetation and trees in the plaintiff's park are seriously injured by noxious vapours. It is also, in my opinion, proved that the presence of sulphuric acid, or sulphurous acid, is prevalent on the leaves and grass in various places in the plaintiff's park. It is also proved that a very considerable amount of sulphurous acid escapes from the works of the defendants—as much as 14 ounces per minute from the cupola chimney, and 11 ounces per minute from the lofty chimney, and that this occurs although they are so constructed as to consume their own smoke, and this on the most approved method, and although no dense vapour escapes from either chimney. This goes a great way in the plaintiff's favour, but I think the evidence fails in showing that the injury to the trees and vegetation is attributable exclusively, or indeed mainly, to the defendants' works. The escape of sulphur from the other chimneys at Sowerby-bridge, according to the evidence before me, amounts to six times as much as

that which escapes from the defendants' works; besides which, there are bleaching works where sulphur is burnt, and where, consequently, a considerable escape of sulphurous acid must take place; and although the evidence does not enable me to estimate accurately the amount which does so escape, it must, I think, be considerable. The defendants' works are also close to the gas works, from whence it appears that some escape of sulphuretted hydrogen takes place, and although the amount of it is not proved, yet some of it must occur. This evidence might be neutralised if it were established that the injury to the trees and vegetation took place in the immediate neighbourhood of the defendants' chemical works and where the vapour from these works alone could extend. But this is not so. The injury to the trees is very capricious, and some which stand very near the works are not affected at all, while others, more distant, are very seriously injured. The attempt to establish that this is occasioned by accidental shelter is very far from producing conviction in my mind as to the truth of the cause alleged. That the defendants' works do contribute their quota of injury to the plaintiff I do not doubt, but I am by no means clear that if their works were put an end to to-morrow the plaintiff's park would benefit by it, or that it would not appear to be in a position just as injurious the next year as if their works had been carried on. I have in vain endeavoured to reconcile the evidence with any particular theory as to the place from whence the noxious vapour flows, and I believe it to be impossible to do so. I think the most probable solution of the case is that the whole atmosphere around is impregnated with substances more or less injurious to vegetable life, and that these substances affect some trees, and some places, more than others—not merely because the wind is principally in that direction, as is the case on the west side of the trees, of which some striking instances are shown, but also arising, in some measure, from the accidents of the soil, and other natural accidents, which render some trees more susceptible of this peculiar injury than others. At all events, after trying very much, I have failed in being able to trace distinctly the injury proceeding from the defendants' works as to justify me in granting any injunction. In addition to this failure on the part of the plaintiff, there is another circumstance which, in my opinion, tells much in support of the view that I have taken of the case on the question of the relief sought by this bill. The works of the defendants were established upwards of forty years ago—I think in 1819. Since then they have much increased, and particularly since 1857. But simultaneously with the increase, or nearly so, improvements have been made which, according to all the evidence, which on this part of the subject is all one way, have materially diminished the escape of noxious vapours. And this was particularly accomplished by alterations and improvements made in the year 1859. I have found it impossible to arrive, on the evidence, even at a distant approximation as to the amount of noxious vapours which escape from the defendants' works now as compared with those which escaped from them prior to the year 1859. For anything that appears, it may have been worse then than it is now; and if so, the question arises—When did the vapours first begin to be injurious to the neighbouring vegetation? I do not believe that it has ever been decided that prescription to foul a running stream, or to impregnate the air with noisome or noxious vapours can be established against the public; but, unquestionably, it can be established against a particular individual who has seen it going on for upwards of twenty years, and has taken no steps to prevent it. It is incumbent, in such a case that the suffering proprietor should seek the assistance of this court as soon as the nuisance is really perceptible, according to the doctrine laid down in many cases, and which I followed lately in the case of *Goldsmid v. the Tunbridge Wells Commissioners*. On this subject, in the present case, I am left in the dark. My surmise, drawn from the evidence, is—that if the present injury proceed

from these works, as is alleged by this bill, this injury must have been perceptible more than twenty years ago, and as it is from the cupola chimney, which is said to be the main cause of the injury, and as this has been in the same situation since 1859, when it was made much less hurtful than it was before the present state of the vegetation is more attributable to the general increase of the neighbouring manufactures than to these works themselves; and in my opinion I am unable, as I am invited to do, to draw any safe conclusion or analogy from the effects produced by London smoke, or by that of our other large towns, even if I had, which I have not, any trustworthy evidence on the subject as applied to the effects of a mass of manufactures with smoking chimneys, contracted in a narrow valley, and as to which the vapours must be for the most part confined. I have therefore come to the conclusion that the plaintiff has not made out his case; and as the burden of proof rests on him, his bill must be dismissed. I had thought at one time of offering to him an issue; but, having regard to the lapse of time, which cannot be tried by an issue, and also considering that according to my experience in this court an issue entails great expense, and ultimately, for the most part, leaves the parties very much as they were before, I have determined not to adopt this course, but to dismiss the bill *simpliciter*; and therefore I dismiss the bill with costs."

MEETINGS FOR THE WEEK.

MONDAY—Medical, 8 p.m.
WEDNESDAY—Society of Arts, 8 p.m.
— Geological, 8 p.m.
— London Institution, 6½ p.m.
THURSDAY—Royal, 8½ p.m.
— Zoological, 4 p.m.
— Chemical, 8 p.m.
— Philosophical Club, 6 p.m.

TO CORRESPONDENTS.

H. Boyes.—The cause of the effervescence of aerated liquids when a foreign body is introduced into them (*i.e.*, bread into champagne) was fully explained in a paper by Mr. Tomlinson, F.R.S., which appeared a few months ago in the *CHEMICAL NEWS*.

E. Kerman.—The *Moniteur Scientifique* is a very good scientific journal. The publisher can supply you from our office. *Les Mondes* can also be sent from our office. The subscription, post free, is £1.12s. per annum, in advance.

W. Schofield.—The matter is under consideration. We will communicate again on the subject.

Professor Weltzien.—Your letter arrived some time ago, but not the book.

J. Bournes.—Our publisher has answered your first question. 2. Galloway's chemical tables are sufficiently large for class teaching, but we believe they have not yet been printed with new atomic weights and most recent formulae.

X. Y. Z..—In examining white lead mixed with oil, it is best to extract the oil with ether or chloroform, and then examine the residue with acids, &c., in the ordinary way. If you ignite to drive off the oil you will in all probability alter the composition of the lead compound.

Hg.—There is no particular physical reason why the other planets should not be inhabited. Venus would, however, be preferable to Mercury to human beings constituted like ourselves, for on the former planet a body weighing 1 lb. on the earth would weigh 0.98 lb., and the light and heat received would be 191 times that received by the earth. On Mercury a pound weight would weigh 1.06 lbs., whilst the proportion of light and heat would be 668 times that received by the earth. This excessive radiation may, however, be in a great measure intercepted by a dense atmosphere.

Communications have been received from J. Imray, C.E.; G. H. Jennings (with enclosure); J. Gra. Tatters; W. A. Jackson; S. Scott (with enclosure); H. E. Roscoe, F.R.S. (with enclosure); J. Baxendell, F.R.S. (with enclosure); H. Simkinson; Dr. F. C. Calvert, F.R.S. (with enclosure); Dr. Sanson (with enclosure); J. Masterman; Professor Tyndall, F.R.S.; J. Ellison (with enclosure); H. Spence; M. Williamson; Jabez Hughes; W. Scott; G. F. Rodwell; J. A. Wanklyn (with enclosure); Rev. F. Sonley Johnstone; T. W. Cowburn; G. F. Barker, M.D. (with enclosure); Dr. A. W. Hofmann, F.R.S.; Youngman, Brothers; Professor J. H. Pepper; H. K. York; H. S. Bradford (New York); G. Maurice; R. Reading; Young's Paraffin Light and Mineral Oil Company; Nicholson, Taylor, and Co.; H. R. Marsden; M. Dougall, Bros.; D. Knight; W. Smith and Co.; H. Baillière; E. Riley; R. Le Neve Foster; G. W. Eccles; Dr. Quesneville (with enclosure).

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London: J. H. Dutton, CHEMICAL NEWS Office, Boy Court, Ludgate Hill. E.C.

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THE CHEMICAL NEWS.

VOL. XVI., No. 420.

CRYSTALLOGRAPHY AND THE BLOWPIPE.

By W. A. ROSS, Captain, R.A.

I HAVE the pleasure to inform you of a new feature in blow-pipe manipulation lately discovered by me, which I am sanguine enough to hope may add another to the many results obtained in chemical and mineralogical analysis by this invaluable little instrument.

It struck me that, as the decomposition of light by inflection or diffraction is analogous to that by absorption and transmission through a prism, and as the latter operation has been applied so successfully to the recognition of blow-pipe flames of metals, as lithium, barium, &c., in the spectroscopic, small *bladders* or *bubbles* of borax of sufficient tenuity to diffract rays of light, if containing certain metals or oxides in solution, would afford, when cool, corresponding chromatic rays, in daylight. It is true that Sir I. Newton attributed the different colours obtained by diffraction solely to the relative thickness or distance between the reflecting surfaces, but, as Sir D. Brewster remarks, he "inferred that they were produced by a singular property of the particles of light, in virtue of which they possess, at different points of their paths, *fits* or *dispositions* to be reflected from, or transmitted by transparent bodies. Sir Isaac does not pretend to explain these *fits*, but terms them *fits of transmission* and *fits of reflection*." Now why should not these "*fits*" be caused by some peculiarities in the composition of the reflecting body? The colours on a soap bubble are surely not solely attributable to its thickness and thinness in different parts; and we must all recollect as boys how not only the quantity but quality of the soap was a *sine qua non* of success.

The following table, which I have prepared from actual experiment in every case, will, I think, fairly show that a richer play of colour is yielded by metallic solutions than in the pure *vesicula* of borax, and it appeared to me very remarkable that such a highly colouring agent of borax as cobalt should yield nearly transparent *vesicula* showing little or no iridescence. I remarked also that a copper vesicle gave almost the same play of colours as is seen in the ore called "peacock copper" in which a rich blue is very predominant, while in several vesicles of bismuth, which I made, no blue at all could be observed, but a great predominance of pale green.

Carbonate of baryta,	very slightly iridescent
Borax	 "
Microcosmic salt	 "
Oxide of copper	 highly "
.. cobalt	.. nearly clear vesicle
.. nickel	.. slightly iridescent
.. bismuth	.. very highly "
.. tin	.. highly "
.. manganese	.. very highly "
Nitrate of potash	.. highly "
Iodide of potassium	.. very highly "

I made no attempt to classify the colours reflected by different metals in solution, but they always appeared in prismatic bands of blue, green, yellow, orange, red, &c.

Next day a new feature in these *vesicula* attracted my attention, which I hope will add to their importance as analytical agents, and develope besides an elegant application of the science of crystallography to blow-pipe examination which it has not yet received.

Observing that a cloudy film containing white spots had gathered over the vesicle holding *carbonate of baryta*

in solution, I examined the spots with a microscope, and found them to be round radiated crystals having a dark nucleus or centre.

I then made a borax vesicle containing *nitrate of baryta*, and allowed it to stand for several hours, after which a film displaying similar crystals, but with a *white* nucleus or centre, appeared. A vesicle containing carbonate of potassa showed, after a time, a film without crystals exactly like finely ground glass. *Carbonate of magnesia* appeared in beautiful crystals, like the flowers of a convolvulus, having six petals, with a double rim or edge, and a dark nucleus. *Sulphate of magnesia* displayed similar flower-like crystals without the rim or nucleus.

I now found to my surprise and pleasure that every one of thirteen borax vesicles I had placed on cotton overnight was covered more or less with similar crystals peculiar to itself, and strongly differing from those of the other vesicles, unless, as in the case of magnesia, they contained a common base. Thus *nitrate of silver* appeared in almost perfect stars, radiating from an extremely white central point which again was surrounded by a dark aureola. A *silicate of lithia* (lithionglimmer) also appeared in stars, but of a perfectly different shape, having no nucleus and large cups of unequal length. *Oxide of cobalt*, the vesicle containing which was colourless when newly made, now appeared in a series or net-work of transparent crystals like the glass manufacture termed "imitation ice." *Strontianite* seemed to crystallise in octohedral planes having large dark nuclei, while *bichloride of platinum* produced nearly circular flowerets having an inner ring but no nucleus, and veined like the wing of a fly. The *teroxide of bismuth*, on the contrary, appeared in crystals like extremely white and small feathers.

Thus it will be seen that, whatever the cause, different solutions of metals or their oxides in borax, produce, when blown into *vesiculae* and allowed to stand for a night, different and peculiar crystals; a fact which I have allowed myself to hope, will enable the careful observer to determine the composition of these substances more rapidly, certainly, and easily, than by any other method, as this one is effected by the operation of the laws of nature herself. All that is required seems to me to be a careful representation and classification of these crystals obtained by means of a powerful microscope, and as the vesicles, with the exception of the crystals upon them, are, in dry weather, generally transparent, these latter might almost, I should think, be magnified and represented by means of the polariscope.

I have made sketches of thirteen crystals observed by me, but although they convey perhaps a general idea of the shape, they are very far from showing, in the least degree, the beautiful detail and variety observable in the structure of each of these crystals. I observed also that these vesicles develope electricity, some in a greater degree than others, which may be referable to their different composition. Seeing that two of them adhered together so fast that they could not be separated without breaking one of them, although quite dry and smooth on the outside, I applied a piece of rubbed sealing wax to several, and attracted most of them vigorously, but some, on the other hand, did not show the least attraction.

Some of the saliferous vesicles—notably the nitrate of potassa, and carbonate of soda—delequessed so rapidly that although they crystallised, I failed to observe the shape of the crystals,* and indeed in damp weather, like the present, the general results of this system are bad—I cannot to-day obtain a second set of crystals of carbonate of soda, the vesicle containing it deliquescing into holes before the crystals can be even formed.

When the phenomena of these vesicles have been observed, they can be remelted into beads by holding the platinum wire sustaining them in the gas or spirit lamp flame, in which process the thin shell of the vesicle

* I obtained and sketched crystals of these afterwards.—W. A. R.

effloresces in a manner apparently peculiar to the salt which it contains. Thus oxide of bismuth has a *frothy*, nitrate of silver a *creamy*, efflorescence. If a newly made vesicle be applied to the gas flame, no efflorescence at all takes place, but the borax melts transparently down to its bead.

It now only remains for me to explain how the process of vesiculation is carried out. I perform it as follows:—I fuse a bead of borax on the platinum wire in the usual way, and charge it with the salt or oxide of which the crystals and diffractive colours are desired. After holding it for some time in the *reducing* flame, I withdraw both the bead and the blowpipe from the flame, keeping the latter still pressed against my mouth and blowing through it; I then bring the jet of the blowpipe rapidly opposite the ring of the platinum wire (which should be of the size of a pin's head and as round as possible), through which the stream of air issuing from it blows out a vesicle or bladder formed of the fluid bead of borax and the substances contained in it.

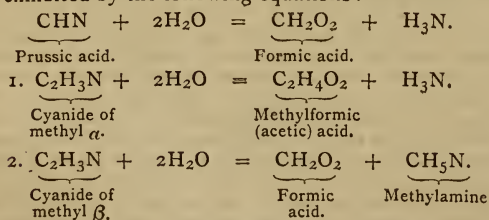
Woolwich, Dec. 2, 1867.

ON A NEW CLASS OF BODIES HOMOLOGOUS TO HYDROCYANIC ACID.*

By A. W. HOFMANN, LL.D., F.R.S.

THE typical transformation which hydrocyanic acid undergoes when submitted, under appropriate circumstances, to the action of water, is capable of assuming two different forms when accomplished in its homologues.

If the hydrocyanic molecule be found to fix the elements of two molecules of water, yielding ultimately formic acid and ammonia, it is obvious that the atom group which in the homologues of hydrocyanic acid we assume in the place of hydrogen, may be eliminated when these homologues are decomposed by water in conjunction either with formic acid or with ammonia. To take an example:—When acting with water upon the simplest homologue of hydrocyanic acid (upon cyanide of methyl), we may expect to see the methyl-group separating either in the form of methyl-formic, *i.e.* acetic acid, or in the form of methyl-ammonia, *i.e.* of methylamine. The difference of the two reactions and their relation to the metamorphosis of hydrocyanic acid itself are exhibited by the following equations:—



The former one of these processes of transformation is familiar to chemists from the study of the hydrocyanic ethers or nitriles. The first member of this remarkable group of bodies (cyanide of ethyl) was discovered by Pelouze; the general character of their transformation was subsequently established by the beautiful investigations of Kolbe and Frankland on the one hand, and by those of Dumas, Malaguti, and Le Blanc on the other.

Researches in which I have been engaged during the last few weeks have proved that the second process of transformation does not less frequently occur. Indeed I have found that there corresponds to each of the hydrocyanic ethers or nitriles known hitherto, a second body of precisely the same composition but of absolutely different properties. These substances, when changed

by water, undergo the transformation which is exhibited by the last one of the three above equations.

A happy experiment has led me to the discovery of this new class of bodies. In a lecture I wanted to exhibit the interesting transformation of ammonia into prussic acid by means of chloroform, which was first observed by M. Cloez, and which illustrates so well our present views on quantivalence. When the two substances alone are allowed to act upon one another, this reaction can be rapidly accomplished only at a high temperature and consequently under pressure. I order to shorten the process (in one word, in order to exhibit this important reaction in a lecture-experiment), I had added potash to the mixture for the purpose of fixing the newly formed prussic acid, and was delighted to find that a few seconds' ebullition was sufficient to yield a considerable amount of cyanide of potassium, so as to furnish, after the addition of the two salts of iron, a large quantity of Prussian blue. On subsequently repeating the experiment with some of the derivatives of ammonia, more especially with several primary monamines, I was astonished to observe in each case a powerful reaction giving rise to the evolution of vapours of an almost overwhelming odour, strongly recalling that of prussic acid. But few experiments were necessary for the purpose of isolating the odoriferous bodies. The compounds thus formed are the substances isomeric with the hydrocyanic ethers or nitriles hitherto examined.

From the host of bodies which were thus suddenly thrown into view, it was necessary to single out the compound of a particular series in order to determine by accurate experiments the nature of the new reaction. The facility of procuring the necessary material, as well as old predilections, suggested the phenyl-series as the one to be examined in the first place. I beg leave to submit to the Royal Society a brief account of the mode of preparation, and of the principal properties, of the new derivative of aniline.

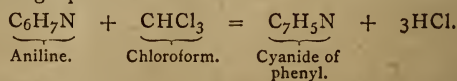
Cyanide of Phenyl.

A mixture of aniline, chloroform, and alcoholic potash yields on distillation a liquid of a powerfully aromatic but, at the same time, hydrocyanic-acid-like odour. The vapour of the liquid gives rise to a peculiar bitter taste, and causes, moreover, in the throat the suffocating sensation so characteristic of hydrocyanic acid. On redistilling the liquid, alcohol and water pass first, and ultimately an oily body is procured, which, in addition to the smelling substance, still contains a large amount of aniline. The latter is separated by oxalic acid, when the powerfully smelling compound remains in the form of a brownish oil. Freed from water by hydrate of potassium and purified by distillation, the new body presents itself as a mobile liquid, exhibiting a greenish colour in transmitted, and a beautifully blue colour in reflected light. This colour does not disappear by distillation even in a current of hydrogen.

The analysis of the blue oil has established the formula



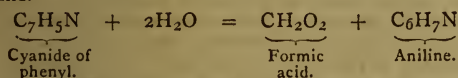
The compound is thus seen to be isomeric with benzonitrile, discovered by Fehling, from which it differs, however, in all its properties. In order to distinguish the new compound from benzonitrile I will call it *cyanide of phenyl*, without intending, however, by selecting this name, to express any particular view as to its constitution. The formation of cyanide of phenyl is represented by the following equation:—



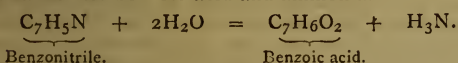
Cyanide of phenyl cannot be volatilized without undergoing decomposition. During distillation the thermometer marks for some time the constant temperature of 167°.

* Paper sent to the Royal Society during the recess.

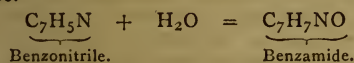
which may be taken as the boiling-point of cyanide of phenyl. Then the temperature rises rapidly to from 220° to 230°. The brown liquid which now distils is destitute of odour, and solidifies on cooling to a crystalline mass, easily purified by solution in alcohol, but not yet more minutely examined. Cyanidine of phenyl is remarkable for the facility with which it combines with other cyanides. The compound with cyanide of silver is particularly beautiful. The behaviour of cyanide of phenyl with acids is more especially characteristic. Scarcely changed by the action of alkalis, it cannot be left in contact even with moderately dilute acids without undergoing alteration. When submitted to the action of concentrated acids, the liquid bursts into ebullition, and the solution, after cooling, contains only formic acid and aniline.



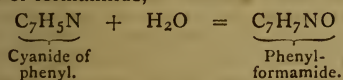
Benzonitrile, isomeric with cyanide of phenyl, is known to be slowly attacked by acids, but to be rapidly transformed by alkalis into benzoic acid and ammonia.



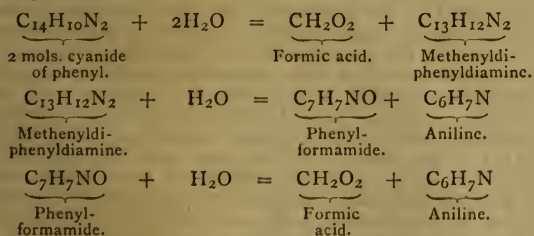
The transformation of benzonitrile into benzoate of ammonium, as, indeed, the transformation of the nitriles into the ammonium-salts of the respective acids generally, is not accomplished in one single bound. By fixing only one molecule of water, benzonitrile is first converted into benzamide.



Nor is the corresponding term of the isomeric series wanting. This substance has long been known as phenyl-formamide or formanilide,

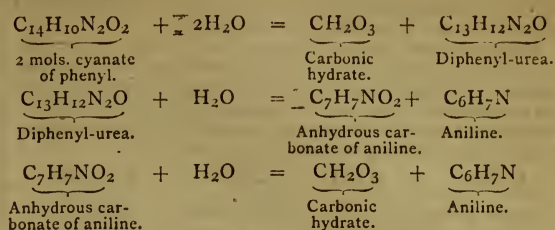


But, in addition to phenyl-formamide, there figures in this series a second intermediate compound, the analogue of which among the derivatives of benzonitrile is not yet perfectly known.* This compound is the well-defined base which some time ago I described as methenyldiphenylamine, and which may be looked upon as formed by the association of a molecule of cyanide of phenyl with a molecule of aniline. The successive changes which cyanide of phenyl undergoes when submitted to the influence of water are thus exhibited by the following series of equations:—



A glance at these formulæ shows that the metamorphosis of phenylic cyanide is perfectly analogous to

that of phenylic cyanate, which I have studied at an earlier date.



Cyanide of Ethyl.

After having fixed in the phenylic group the general characters of the reaction, my attention was very naturally directed to the ethylic series. For this purpose, it was first necessary to procure ethylamine in rather considerable quantities. Happily in this case the liberal co-operation, so often experienced, of my friend Mr. E. C. Nicholson, was again at hand. Interesting himself with a cordiality, for which I cannot sufficiently thank him, in the continuation of my researches on the ethylic bases, Mr. Nicholson had placed at my disposal the product of the action of ammonia on iodide of ethyl produced in a single operation performed in one of his great autoclaves on 20 kilogs. of iodide of ethyl.

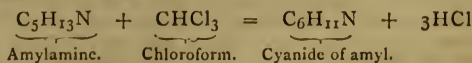
Thanks to the happy alliance between science and industry, which characterises our times, I was thus enabled to study the transformation of ethylamine under the influence of chloroform on a rather large scale.

On gradually introducing a mixture of an alcoholic solution of ethylamine and chloroform into a retort containing powdered potassic hydrate, a most powerful reaction takes place; the mixture enters into ebullition, and a liquid distils over, the penetrating odour of which surpasses anything that it is possible to conceive. Besides the odoriferous body the product of the distillation contains ethylamine, chloroform, alcohol, and water, and a considerable number of redifications are required in order to isolate the cyanide of ethyl from this mixture.

As the substance is rather volatile, the frequently repeated fractional distillations become a most painful operation, and more than once, while I have been engaged in these experiments, my laboratory has been almost inaccessible. Thus with a temperature of 30° I have found it desirable to interrupt for the time the preparation in the pure state of the cyanide of ethyl, and to resume it at a more favourable season.

I was nevertheless curious to study, even now, a true homologue of cyanide of ethyl in order to compare its properties with those of cyanide of phenyl. The boiling-points of the anylic compounds being within convenient limits, I was induced to select the amyl-series as presenting the greatest chance of success.

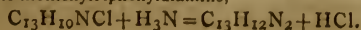
On submitting amylamine to the action of chloroform, the same phenomena are observed as in the analogous reaction between chloroform and aniline. One molecule of amylamine and one molecule of chloroform contain the elements of one molecule of cyanide of amyl and three of hydrochloric acid:—



The cyanide of amyl is a transparent colourless liquid lighter than water, insoluble in water, but dissolved by alcohol and ether, of an oppressive odour, resembling at the same time that of amylic alcohol and of hydrocyanic acid. Its vapour possesses, in a still higher degree than that of the cyanide of phenyl, the property of producing on the tongue an insupportably bitter taste, and of giving rise in the throat to the sensation of suffocation, so characteristic of hydrocyanic acid.

The cyanide of amyl may be distilled without decomposition. It boils at 137° C., that is, at a temperature 8°

* Shortly before his death, Gerhardt was engaged in experiments on the action of pentachloride of phosphorus on the amides, a brief account of which was subsequently published by M. Cahours. Among other substances, I find that, by acting with pentachloride of phosphorus upon benzanilide, Gerhardt obtained a chloride, $\text{C}_{13}\text{H}_{10}\text{NCl}$, which yields with ammonia a crystalline substance. It can scarcely be doubted that this compound is the derivative of benzonitrile corresponding to methenyldiphenylamine,



diseased cattle contained the germs or sporules of the microscopic animals discovered by Mr. Beale in the blood of such animals; for Mr. Crookes having condensed on cotton wool these germs, and having inoculated the blood of healthy cattle with them, they were at once attacked with the disease. As to the value of carbolic acid for preventing the spread of cholera, among many instances which I could cite, allow me to mention two special instances: First, Dr. Ellis, of Bangor, says:—“I have in many instances allowed whole families to return to cottages in which persons had died from cholera, after having had the cottages well washed and cleansed with carbolic acid, and in no case were any persons so allowed to enter such purified dwellings attacked with the disease. My friend, Professor Chandelon, of Liège, has stated to me that out of 135 nurses who were employed to attend upon the cholera patients—and they must have been numerous, for 2,000 died—only one nurse died, but the nurses were washed over and their clothing sprinkled with carbolic acid. In fact the antiseptic properties of carbolic acid are so powerful that 1-10,000th, even 1-50,000th will prevent the decomposition, fermentation, or putrefaction for months of urine, blood, glue solution, flour, paste, fœces, &c., &c.;* and its vapour alone is sufficient to preserve meat in confined spaces for weeks; and even a little vapour of this useful substance will preserve meat for several days in ordinary atmosphere, and prevent its being fly-blown; lastly, 1-10,000th has been found sufficient to keep sewage sweet, for Dr. Letheby states, in a letter addressed to me, that through the use of such a quantity of carbolic acid in the sewers of London during the existence of cholera last year, the sewers of the City were nearly deodorised. And I am proud to say that the British Government have decided to use exclusively our carbolic acid (as an antiseptic and disinfectant) not only on board Her Majesty's ships, but in other Government departments; and that no other deodorant or disinfectant, such as chlorides of zinc or iron, permanganate of potash, or any disinfecting powder, shall in future be used for such purpose. Although questions of public health are the province of medicine, still permit me to say a few words on the medicinal properties of carbolic acid. This question deserves to be treated thoroughly, for phenic acid is susceptible of so many applications in this direction; its properties are so marked, so evident, and so remarkable, that they cannot be made too public, and it is rendering a service to mankind to make known some of the employments of so valuable a therapeutic agent.

I wish all who are listening to me were medical men, for I could show, by numerous and undeniable facts, the advantage they might derive from pure carbolic or phenic acid, and if my testimony was not sufficient to convince them, I would invoke the authority of men justly esteemed amongst you. I would recall to you the words of the good and learned Gratiolet, and those of Dr. Lemaire, showing that carbolic acid is the most powerful acknowledged means of contending with contagious and pestilential diseases, such as cholera, typhus fever, small-pox, &c.† Maladies of this order are very numerous, but in carbolic acid we find one of the most powerful agents for their prevention, for besides many instances which have been cited to me, I may add that I have often used it in a family in which there were eight or ten children, and that none of the family have suffered from those diseases except those who were attacked previously to the employment of carbolic acid about the dwellings in which such diseases existed. Besides its antiseptic action, the caustic properties of carbolic acid are found useful; most beneficial effects are obtained from it in the treatment of very dangerous and sometimes mortal complaints, such as carbuncle, quinsy,

diphtheria, &c., as shown by Dr. T. Turner, of Manchester; and also in less severe affections, such as hæmorrhoids, internal and external fistulas, and other similar complaints. But what must be especially mentioned is the employment of carbolic acid in preserving in a healthy state certain effect. purulent sores, and preventing the repulsive odour which comes from them, an odour which is the symptom of a change in the tissues, and which often presents the greatest danger to the patient. The services which carbolic acid renders to surgery can be judged of by reading several most interesting papers on compound fractures, ulcers, &c., &c., lately published in the *Lancet* by J. Lister, F.R.S.; and allow me to draw your special attention to the following paragraphs which are to be found in his paper published in that journal of the 25th September, 1867:—“The material which I have employed is carbolic or phenic acid, a volatile organic compound, which appears to exercise a peculiarly destructive influence upon low forms of life, and hence is the most powerful antiseptic with which we are at present acquainted. The first class of cases to which I applied it was that of compound fractures, in which the effects of decomposition in the injured part were especially striking and pernicious. The results have been such as to establish conclusively the great principle that all the local inflammatory mischief and general febrile disturbance which follow severe injuries are due to the irritating and poisoning influence of decomposing blood or sloughs. These evils are entirely avoided by the antiseptic treatment, so that limbs which otherwise would be unhesitatingly condemned to amputation may be retained with confidence of the best results. Since the antiseptic treatment has been brought into full operation, and wounds and abscesses no longer poison the atmosphere with putrid exhalations, my wards, though in other respects under precisely the same circumstances as before, have completely changed their character; so that during the last nine months not a single instance of pyæmia, hospital gangrene, or erysipelas has occurred to them.” My hearers can also witness the same remarkable results by visiting the two sick wards of Dr. Maisonneuve, at the Hotel Dieu. Further, I must not overlook the valuable application made of it to gangrene in hospitals by the eminent physician, James Paget, Esq.; and lastly, it has been used by many of the most eminent medical men with marked success in those scourges of humanity, phthisis and syphilis.

In agriculture our firm has stimulated the employment of the carbolic acid for the cure of certain diseases very common to sheep—scab, for example. The method of treatment customary in similar cases was very imperfect as well as dangerous, whilst with carbolic acid this malady is cured, and without danger to the animal, by dipping it for a minute, often only for some seconds, in water containing a small quantity of carbolic acid. For this purpose pure acid would be too expensive, and is not used, nor concentrated acid, which ignorant men who have the care of sheep would not know how to use, but by the help of soap an emulsion of carbolic and cresylic acids is made. After having shorn the sheep it is dipped in this mixture; a single immersion in a bath containing 1-60th of it is sufficient to effect a cure. After scab, the foot-rot is one of the worst and most frequent complaints. Carbolic acid is also for that an efficacious remedy. For this a mixture is made of the acid and an adherent and greasy substance, capable of forming a plaster, which is made to adhere to the animal's foot for two or three days, preventing the contact of the air, allowing thereby time for the application to have its effect. But if the flock be numerous, it would take a long time to dress the four feet of each animal one after another; so, to make it more easy, a shallow tray is made of stone—a sort of trough; this is filled with the medicated mixture, and the sheep made to pass through it; their feet being thus impregnated with the required substance. Permit me also to state that cattle cease to be annoyed with flies

* See private reports made by Dr. Allen Miller, F.R.S., and Mr. Crookes to Messrs. F. C. Calvert and Co.

† See Mr. Lemaire's work on Phenic Acid. Paris, 1865.

&c., if washed with this solution, or a weak solution of carbolic acid; and a first-rate salve can be prepared by adding 10 per cent of carbolic acid to butter, or any other fatty matters used for such purpose.

Manufacturers have not yet availed themselves of one tithe of the valuable properties of carbolic acid, and in this direction a new field is open to its use; still I may cite a few instances. The preservation of wood has been already referred to, and thanks to carbolic acid, the great trade in skins and bones from Australia, Monte Video, Buenos Ayres, &c., will ultimately be benefited. Wild animals; living there in herds are slaughtered by thousands. Formerly they came to us in a bad state, half putrid, emitting an insupportable odour, and only fit for manure; in this state their price was not more than 150 francs the 1,000 kilogrammes, now, with carbolic acid treatment, they arrive perfectly preserved; they can be employed for all the uses to which green or raw bones are usually applied, and the value of bones is raised as much as from 250 to 300 francs. Hides also often arrive putrid, although they have been dried rapidly in the sun or salted, which latter process, as you are aware, necessitates long and costly manipulations; whilst it is only necessary to immerse them for twenty-four hours in a solution of 2 per cent. of carbolic acid, and dry them in the air, to secure their preservation. It is probable that in a short time the blood, intestines, and other parts of these animals will be, by means of carbolic acid, converted into manure, and imported into this country. In England carbolic acid is used in the preservation of guts at the gut-works, for keeping anatomical preparations, and the preservation of all animal matter. Carbolic acid is also utilized in preventing the decomposition of the various albumen, flour, and starch thickeners used in calico printing, as well as gelatine or bone size, employed for sizing fustians and other cotton goods.

One of the most interesting chapters in the history of carbolic acid is certainly that which relates to the production of colouring materials; they alone enter into comparison with those derived from aniline, and often enter into successful rivalry with them. Amongst the colouring matters derived from carbolic acid, the most important is, without fear of contradiction, picric acid.

The discovery of this acid dates back to a distant period; it was studied by Welter, and was called Welter's bitter. But it was my illustrious master, M. Chevreul, who in 1807 discovered the real chemical composition of picric acid, and who demonstrated that picric acid was often produced when organic matters were acted upon by nitric acid. Further, M. Chevreul discovered in the products of the oxidation of organic substances through nitric acid two different compounds, which he called *amer au minima* and *amer au maxima*, the latter being picric acid. This acid was again examined by Laurent in 1841, when he demonstrated that the true generator of picric acid was phenic acid; that in the action of nitric acid on the latter it formed three nitrogenated compounds, mononitrophenic acid, binitrophenic acid, trinitrophenic acid, the latter being also picric acid.

These interesting results of Laurent would perhaps have remained for a long time without any commercial value, if picric acid had not been applied to dyeing, in 1847, by M. Guinon, sen., of Lyons. Since then the use of this acid, producing magnificent yellows, has been much extended, and what has contributed to its employment is that, conjointly with indigo, it gives ordinary greens, or of *vert Lamière* with Prussian blue, so that its consumption may be valued at from 80 to 100,000 lbs. annually; our firm alone produces more than 300 lbs. weekly; and when it is considered that 1 lb. of picric acid dyes to an intense shade 70 to 100 lbs. of silk, or 40 to 50 lbs. of wool, the enormous quantity of textile materials dyed by this single product may be appreciated.

The processes followed for the preparation of picric acid are still those which Laurent indicated in 1841; but instead of using carbolic acid loaded with the heavy oils of tar, as

M. Guinon had done, I sought to diminish the quantity of nitric acid, employed in mere waste, on the heavy oils of tar, which were then mixed with carbolic acid, and I am glad to say that I succeeded in doing so in 1849 by employing carbolic acid containing only some of its liquid homologues. In 1856, M. Bobœuf took out a patent in France for making picric from carbolic acid. But picric acid was still at a high price, and it is only since our firm has manufactured cheap carbolic acid that picric acid can be produced free of resinous materials which prevent its purification and its being sold at a low price; in fact, owing to our pure carbolic acid, picric acid is now obtained chemically pure; this product, which was sold some years since at 15s. to 20s. per lb., is now sold at the rate of 3s. Further, I may add that to apply it in a quick and economical manner it is desirable to add to the dye bath a small proportion of sulphuric acid; this method of manipulation, which is not generally known, is very important, for it is only in this way that the textile materials can be readily dyed and the baths exhausted.

(To be continued.)

PROCEEDINGS OF SOCIETIES.

ACADEMY OF SCIENCES.

December 9, 1867.

Stellar Spectra—Ozonometry—Dialysis of Induction Currents—Electrolysis of Organic Salts.

This day's meeting of the Academy was opened with the announcement of the death of M. Flourens, the perpetual secretary.

Father Secchi contributed a note on the spectra of stars and meteors.

An interesting memoir was brought forward by MM. Berigny and Salleron, in the form of a reply to a note recently addressed to the Academy by M. Pœy, on the ozonoscopic colourations produced in iodide of potassium and starch, and on the ozonometric scale of M. Berigny.

M. Pœy's note treated of two distinct questions—(1) The various colourations taken by the test-paper under different atmospheric conditions; (2) the insufficiency of M. Berigny's scale.

Without affirming the reaction to be irreproachable, they consider some of the sources of error to proceed from the mode of experimentation which has been in use up to the present time. When the test-paper is exposed for twelve hours in an atmosphere charged with ozone, the reagents undergo complicated decompositions. MM. Berigny and Salleron believe it would be otherwise if the method of making the experiment were modified; they describe at some length a process by which they hope to eliminate sources of error.

One point to which attention is drawn, is the immersion of the test-paper in distilled water immediately a definite tint is reached. When the paper is exposed in an atmosphere containing much ozone the reagent mixture is rapidly decomposed, and if not plunged into water until some hours afterward the iodide of starch possibly undergoes alteration, and does not then produce normal tints; this is especially the case when the air is very moist. This perturbing cause, however, is inherent and is recognised.

With regard to the ozonometric scale, they propose some changes—instead of determining the amount of ozone from the colour the test-paper acquires during twelve hours, they prefer to measure the time necessary for the paper to be exposed to produce a determinate shade of colour. Suppose on a certain day it requires an hour's exposure to obtain the tint, and the next day two hours' exposure is necessary, evidently only half as much ozone is present on the second day as there was the first day. Thus the

quantity of ozone may be said to be inversely proportional to the duration of exposure.

By a mechanical contrivance a band of test paper, twelve centimetres in length, is moved at a definite rate from protection to exposure to the action of the atmosphere. How the test paper is protected from the action of the atmosphere for some hours in the instrument was not explained, and this to your correspondent seems the most difficult and at the same time the most essential point to secure. However, if the band be made to move at the rate of one centimetre per hour, at the end of twelve hours a band of paper twelve centimetres in length will have passed; at one end of it a centimetre will have been exposed for twelve hours, the next for eleven, and so on down to one. The band of paper having thus passed the instrument, it is plunged into distilled water, and colours varying between white and violet are displayed. It is now only necessary to compare this with the standard colour, and to measure the position on the band where the tints are identical. It is then known how many hours it has been exposed.

They choose a faint tint as the standard, as this will be applicable in all latitudes, the fourth tone of the first violet in M. Chevreul's chromatic circles.

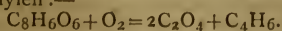
A physical paper on the dialysis of induction currents by M. Bouchotte was presented by M. Becquerel. At the same meeting there was also a paper on the electrolysis of acetic acid by M. Bourgoin. In a former paper the author advanced a theory referring to the electrolysis of organic acids and salts generally. In this he applies it to acetic acid, and gives the detail, of experiments.

The apparatus he arranged was the following:—A tube closed at the upper extremity with a caoutchouc cap, and at the lower extremity closed with the exception of a very small hole. Through the cap passes a small syphon tube almost capillary, as well as a platinum wire, which terminating inside the tube in a plate of that metal, forms one electrode. This tube is encircled by a larger one of such capacity, that when the disengaged gas in the interior exerts a pressure of 4 centimetres, the volume of solution in each tube shall be the same. In the annular space formed by these tubes the other electrode is plunged. Experiments were made with a neutral solution of acetate of potash which had been analysed: after submitting it for six hours to the electrolysis of four elements, a portion of the liquid was drawn off from the neighbourhood of each pole and analysed. The conclusions arrived at are that the decomposition into carbonic acid and carburetted hydrogen is almost *nil*, and that the greatest loss is at the positive pole. Daniell and Miller, M. Bourgoin remarked in his paper, found in the electrolysis of inorganic compounds the negative pole to be that at which the greatest loss occurred. In organic chemistry the only fact known *à propos* of the subject is the observation due to M. Hittorf, who found in the electrolysis of acetate of silver the greatest loss to proceed from the positive pole.

His observation is therefore confirmed by these more recent experiments.

The author sums up the result of his experiments as follows:—

1. The current acts on acetate of potassium as on a mineral substance.
2. In a moderately alkaline solution the oxygen reacts on the elements of the anhydrous acid, and gives rise to a normal oxidation, whence results carbonic acid and hydride of ethylene:—



3. A certain quantity of acid is totally consumed under the influence of oxygen furnished either by the salt or by the alkaline water.

4. The two poles suffer unequal losses. Almost the whole of the salt which disappears belongs to the positive pole.

5. The current acts on the free acetic acid in the same manner as sulphuric acid; it concentrates the acid at the positive pole.

The gas evolved during the electrolysis was found to be chiefly composed of oxygen, with some carbonic acid, and a little carbonic oxide. Acetate of potassium and an alkali in equivalent proportions evolved at the positive pole only oxygen. When the amount of alkali was increased, the same result was obtained, but a concentrated solution of 2 equivalents of acetate of potassium and 1 of alkali yielded oxygen, carbonic acid, carbonic oxide, and carburetted hydrogen.

M. Kolb has expressed the opinion that acetic ether and possibly also a small quantity of methylic ether might be formed. M. Bourgoin observed no formation of these products.

FOREIGN SCIENCE.

(FROM OUR OWN CORRESPONDENT.)

PARIS, DEC. 18, 1867.

Demonstration of Fact that Electricity will not pass through a Vacuum
—Electrolysis of Salts—Colliery Explosion—Construction of Roofs
—New Paint for Houses.

MM. ALVERGNIAT, FRERES, have contrived a new apparatus for demonstrating the fact that the electric spark does not pass through a perfect vacuum. They create a nearly absolute vacuum by means of a mercurial pneumatic machine in the tube which serves for the experiment; this contains two platinum wires, placed at a distance of two millimetres one from the other. Half an hour is sufficient to obtain the necessary degree. At this moment they heat the tube to dull redness, either over charcoal or, more conveniently, by the special lamp employed by M. Berthelot for organic analyses; when the tube arrives at a dull red, the vacuum is continued to be made, and the electric spark is passed until it ceases to pass through the interior of the tube. It is then hermetically sealed, and the tube is separated from the machine.

In a tube thus prepared, in spite of the slight distance between the two platinum points (two millimetres), electricity absolutely ceases to pass.

The above gentlemen now have apparatus at the disposition of professors who would wish to show that electricity does not pass through a perfect vacuum.

M. Bourgoin has published a memoir on the electrolysis of organic acids and their salts. He has found by experiment that the action of the electric fluid is nothing in reality than a fundamental action on all acids and salts, whether mineral or organic; it separates the basic element, which goes to the negative pole, while the elements of anhydrous acid and oxygen, which answer to basic hydrogen or to metal, fly to the positive pole. Such is the fundamental action of the electric current.

The first volume of the Abbé Moigno's "*Lectures on Analytic Mechanics*" (statical part) has just been published. They are based upon the method of Augustin Cauchy, and are extended to the most recent operations of modern times. This work is in 8vo, consisting of 767 pages, and two well-executed copper engravings. Three other volumes or parts are to follow, viz.—Dynamics, Industrial Statics, and Industrial Mechanics.

MM. Sainte Claire-Deville and Pasteur have been named Professors of Chemistry in the Faculty of Sciences of Paris, in the place of MM. Dumas and Balard.

M. Sappey has been appointed Professor of Anatomy of the Faculty of Medicine of Paris, in the room of M. Tarpey. M. Volneuil has been named Professor of Surgical Pathology at the same Faculty, in place of M. Ricbet. M. Moris is appointed Professor of Anatomy at the Faculty of Medicine of Strasbourg.

We have the sad task of recording a fearful colliery explosion in France. On the 12th instant, at 11 a.m., a fire-damp explosion took place, accompanied with the partial falling in of the pit at No. 5 shaft in the Blanzay

mine (Soane et Loire). Eighty bodies have been recovered from the ruins. These melancholy tidings afflict us the more, as M. Chagot, the superintendent, and his co-operators were continually searching for the best means of avoiding these dreadful accidents. The first steps taken by them were the purchase of the excellent apparatus of M. Ansell, which, unfortunately, was not placed throughout the pit. On this occasion, we seriously enjoin M. Guen, of Valenciennes, to carry out as soon as possible the benevolent project of M. Dubrunfaut, who has generously offered a reward of £4,000 and a series of graduated premiums, to be awarded to the inventor of a system which will resolve in the most complete manner the problem of security against fire-damp, or to those who give a partial solution of this vital question. To retard any longer this necessary organisation, and, on the part of coal-mining companies, to defer any longer to answer to the appeal of M. Dubrunfaut, who put down his name for £4,000, would be a great mistake, if not a crime. Our friend, M. Ansell, whose apparatus is constructed in France by M. Salleron, 24, Rue Pavée, Paris, is prepared to make all the experiments and installations of his instrument that may be required, on demand.

The materials with which roofs are generally covered should be paid special attention to by insurance companies. The 29th of last November, at 1 p.m., a violent fire broke out in a hay and corn store, No. 25, Rue du Rocher; in spite of all endeavours, the forage and the premises were rapidly destroyed. The building was roofed with tiles. The next day another fire broke out on the Quai St Cloud, in a house roofed with slates. It commenced in the staircase, and so rapid was the progress of the flames that an English family, inhabiting the house, was obliged to jump out of window. It seems that the principal cause of the rapidity of the spreading of the fire in these cases was principally due to the formation of currents of air through the joints of the roof. Experiments were made by M. Maillard, No. 28, Rue Jean Gougon, in the quarter of the Champs Elysées, which proved that his new substance, mineral carton, was much safer than either tiles or slates or zinc in case of fire. Models on a large scale having been erected in the Avenue Montaigne, they were filled with combustible matter which was set on fire. The zinc roof fell in 7 minutes, the tile roof in 17 minutes, while that covered with mineral carton, after 40 minutes exposure to flame, was sufficiently strong to bear the weight of a man; and the reason of this is that the mineral carton prevents any possible ascensional current of air, without which timber will not burn, the effect being only the slow charring of the beams.

A new preparation of house paint has been invented by M. Hugoulin, principal chemist to the Imperial Navy, by which one can prepare, in a few hours, as much paint as is required, without any other utensils than simple small tubs of metal or wood of sufficient capacity. The best paints usually employed in house painting, and which preserve best the wood, have for bases white lead, minium, oxides of zinc, and lamp black. They are not, as in other paints, simple mixtures of drying oil and mineral substances in powder, but intimately blended compounds, in which the elements are combined without chemical double decomposition.

To demonstrate this, the inventor forms, in any vessel, a liquid paste, perfectly homogeneous, with water and a certain quantity in powder of the substances indicated in the following table:—

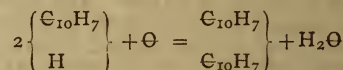
For 1000 grammes of zinc white we can employ	300 or 350 or even 400 grammes.
For 1000 grm. of grey oxide of zinc	150 to 180 "
" white lead	150 to 180 "
" red lead	50 to 60 "
" lamp black	1000 (thereabouts).

In this mixture the necessary quantity of linseed oil is added, in order to form a body colour worked up by the ordinary means.

F. MOIGNO.

CHEMICAL NOTICES FROM FOREIGN SOURCES.

Naphtalene, Action of Oxidising Agents on.—F. Lossen. Naphtalene when treated with a boiling solution of potassic permanganate is oxidised to carbonic anhydride and phthalic acid. Phthalic acid is also formed, besides, a red resinous body, by the action of potassic bichromate and sulphuric acid, or manganic peroxide and sulphuric acid; in the latter case one of the products of oxidation is dinaphtyl, formed according to the following equation:—



Dinaphtyl is a white, crystalline body, which dissolves readily in ether or carbonic disulphide, less in alcohol or benzol, fuses at 150°C. It has been converted into 1. Dibromodinaphtyl, $\text{C}_{20}\text{H}_{12}\text{Br}_2$, soluble in benzol, from which it crystallises well, very readily soluble in a mixture of alcohol, ether, and carbonic disulphide, and fusing at 115°. 2. Hexabromodinaphtyl, $\text{C}_{20}\text{H}_6\text{Br}_6$, a yellowish resinous mass, soluble in ether; sodium amalgam re-substitutes hydrogen with formation of dinaphtyl. 3. Hexachlorodinaphtyl $\text{C}_{20}\text{H}_6\text{Cl}_6$, resembles closely the corresponding bromo-compound. 4. Tetranitrodinaphtyl $\text{C}_{20}\text{H}_{10}(\text{NO}_2)_4$, an orange-coloured, resinous substance, soluble in alcohol. This body, when treated with tin and chlorhydric acid, yields small quantities of a base of very unstable character.

The resinous matter which is obtained by oxidising naphtalene with potassic bichromate and sulphuric acid, or more readily with manganic peroxide and sulphuric acid, contains an amorphous acid of the composition $\text{C}_{20}\text{H}_{14}\text{O}_4$.—(*Zeitschr. Chem* N.F. iii, 419.)

Substituted Alcohols and Aldehydes.—F. Beilstein and A. Kuhlberg. The following compounds were prepared: Paranitrobenzylic acetate, $\text{C}_7\text{H}_6(\text{NO}_2) \cdot \text{C}_2\text{H}_3\text{O}_2$, by adding benzylic acetate to well-cooled, strongest nitric acid, and precipitating with iced water; yellowish needles, fusing at 78°C, readily soluble in hot alcohol. Paranitrobenzylic alcohol, $\text{C}_7\text{H}_7(\text{NO}_2)\text{O}$, by heating the former compound with aqueous ammonia in sealed tubes to 100°; white crystals, fusing at 93°, soluble in hot water and ammonia. Paranitrobenzylic oxalate $[\text{C}_7\text{H}_6(\text{NO}_2)]_2 \cdot \text{C}_2\text{O}_4$, by dissolving benzylic oxalate in strong nitric acid. Like the acetate it gives the alcohol on being heated with ammonia. Benzylic oxalate, $(\text{C}_7\text{H}_7)_2\text{C}_2\text{O}_4$, by the action of chlorbenzyl upon argentic oxalate; crystallises like naphtalene, fuses at 80.5°, insoluble in water, soluble in hot alcohol. Oxidising agents convert the alcohol and all its ethers into paranitrobenzoic acid. Parachlorbenzylic alcohol, $\text{C}_7\text{H}_7\text{ClO}$, by heating chlorbenzylic acetate with ammonia to 160°; scarcely soluble in boiling water, fusing at 66°, is converted into parachlorotoluylic acid, $\text{C}_7\text{H}_7\text{ClO}_2$, on being treated with oxidising agents. Dichlorbenzylic alcohol, $\text{C}_7\text{H}_6\text{Cl}_2\text{O}$, by heating in a sealed tube dichlorbenzylic acetate (obtained by the action of alcoholic potassic acetate on dichlorbenzylic chloride, $\text{C}_6\text{H}_3\text{Cl}_2(\text{CH}_2\text{Cl})$) with ammonia. Parachlorbenzoic aldehyde, $\text{C}_7\text{H}_4\text{ClO} \cdot \text{H}$, by boiling chlorbenzylic chloride, $\text{C}_6\text{H}_4\text{Cl}(\text{CH}_2\text{Cl})$ with an aqueous solution of plumbic nitrate, combining the insoluble oil with sodic bisulphite, and boiling with sodic hydrate. The aldehyde absorbs oxygen, and is converted into parachlorbenzoic acid.—*Zeitschr. Chem.*, N.F. iii., 467.

Paraffin Lamps.—We learn from the *Norfolk* (U.S.A.) *Journal* that it has been found that the light of coal-oil lamps is greatly improved by adding to the oil one-fourth its weight of common salt. It makes the light much more brilliant and clear, keeps the wick clean, and prevents smoking.

CORRESPONDENCE.

THE DECLINE OF ENGLISH MANUFACTURES.

To the Editor of the Chemical News.

SIR,—The relative decline of the industrial arts in England has been ascribed, with more or less probability, to a variety of causes. As far as chemical manufactures are concerned, "strikes" and trades' unions can have had no injurious influence. Neither can excessive wages, since at a chemical works labour bears a lower proportion to the gross returns than probably in any other branch.

As far as opportunity has enabled me to judge, the main root of the evil is the defective education both of managers and foremen, and of common workmen. That the Englishman is naturally inferior in intellect to the German or the Frenchman I deny, but his faculties are not systematically developed; and the school system of this country leaves him in such a state of ignorance, that if you speak to him of "science," he actually thinks you mean pugilism. To expect men thus dragged up to compete with such as have been trained in the schools of the leading continental nations, is as rational as to pit a regiment armed with the old flint-lock musket against one equipped with the needle-gun or the Chassepot. A fact mentioned some time back in the *CHEMICAL NEWS* throws a strong light on the inferiority of this country. The inspectorship of high schools in France was held till lately by the celebrated chemist Dumas. Any similar office in England would be committed not to a man of science, but to a clergyman, a briefless barrister, or a half-pay officer.

Men whose powers of observation have never been cultivated cannot execute the most simple process without mistakes. In proof of this I cite two facts which have lately come under my own observation. A man employed at a large dye-works was sent to the warehouse for a bucket of extract of quercitron-bark. He returned with his pail full of methylated alcohol!—a clear, colourless, transparent fluid, in place of one deep, brown, turbid, and opaque. Another, sent for archil paste, brought a cargo of grease used along with soda for cleansing the goods previous to being dyed. Both the men had worked for years at the establishment, and had had every opportunity of becoming familiar with the articles in question. Such men necessarily occasion their employer waste and loss incalculable. They are a perpetual stumbling-block in the way of the inventor, who is frequently told by practical men: "the process is all right in your hands, but how am I to get my careless men to work it?"

We can maintain supremacy in manufactures only on condition of supremacy in science; and if we are unable or unwilling to arrange our national system of education accordingly, we must be content to fall into the rear.—
I am, &c., W.

MISCELLANEOUS.

Storage of Nitroglycerine.—Another disastrous accident has happened with this recently introduced blasting oil. Unless means are taken by the manufacturers to prevent explosions causing such lamentable results as that which occurred at Newcastle on Tuesday, a valuable blasting agent will be lost to miners and quarriers. If this be the case, however, the manufacturers of it will have themselves to blame, for explosions of nitroglycerine during transport or storage ought to be unknown. Nitroglycerine dissolved in two or three times its bulk of methylated spirit is quite inexplosive, and when required for use, the addition of water will precipitate the oil, the layer of water and spirit merely requiring decanting off. The

nitroglycerine separated in this way possesses explosive properties quite as active as the original oil, which indeed is frequently rather improved than otherwise by the treatment. The process we have described is sometimes used. At Newcastle a part of one canister was found after the explosion marked "safety solution of nitroglycerine in wood naphtha." It is, however, quite certain that there must have been a quantity of oil present either entirely untreated, or treated with an insufficient quantity of the protecting fluid. It should be remembered that nitroglycerine dissolved in a small quantity of methylated spirit or of wood naphtha in warm weather might crystallise out in winter when the temperature approaches the freezing point of water. Probably this is what occurred. Shipping agents and railway companies should refuse to receive nitroglycerine unless protected in the manner already indicated.

Dinner of the Scientific and Manufacturing Chemists of Glasgow.—On Thursday evening, about fifty gentlemen connected with this large and important branch of industry in Glasgow and neighbourhood met at dinner in the Victoria Hotel. The meeting was intended as a preliminary to the formation of a Chemical Society in that city. Mr. E. C. C. Stanford, F.C.S., presided, and Mr. Whitelaw discharged the duties of croupier. Among the company we noticed Professor Anderson, F.R.S., Dr. Wallace, F.C.S., Mr. Leisler, Mr. Townsend, Mr. J. J. Turnbull, Mr. J. N. Cuthbertson, Mr. Galbraith, Mr. Middleton, and others. Mr. Stanford read a note from Professor Penny, stating that he had shortly before received a telegram calling him to Edinburgh, to visit a friend seriously ill, and expressing great regret at his unavoidable absence. After the usual loyal and patriotic toasts, the Chairman, after some introductory remarks, said—The tendency of chemistry appears to be synthetic. The chemist used to be described as a man who could pull anything to pieces and put nothing together—who was troubled with a large bump of destructiveness and a small one of constructiveness. Now the time appears less distant when we shall build up our organic compounds from their inorganic constituents; manufacturing chemistry is following—we are turning to the earth already for many materials which were formerly organic. Some of these changes will at once occur to you. Our sources of potash have been suddenly and enormously aided by the discovery of a large evaporated bed at Strasfurt; and that mine, so admirably worked by Mr. Townsend, has reduced the price of potash to a third its former value. Liebig accused us in passionate language of "turning up the battlefields of Leipsic, Waterloo, and the Crimea for bones; from the catacombs of Sicily we carried away the skeletons of many generations." Speaking of England in 1863, he says—"Annually she removes from the shores of other countries to her own the manurial equivalent of 3½ millions of men, which she squanders down her sewers to the sea. Like a vampire she hangs upon the neck of Europe, and sucks the heart blood from nations." Almost while he was writing this we discovered coprolites in England, and exported phosphates to Germany; and now most of our phosphates are mineral. Guano will doubtless also give way to salts of ammonia and nitrate of soda from the earth. The time is probably not far distant when our large Cinchona plantations will be rendered useless by the introduction of artificial quinine. And a change may come over our Turkey-red makers by the production of artificial guarancin. Does any one think this visionary? Let me remind him that not long ago we imported nearly all our dyes, and now we are the largest colour exporters. Our dyes are dug from the earth. Can anything be more wonderful than extracting from coal the sun's light of a bygone age, and splitting it up into all the colours of the rainbow? or, as in Mr. Young's discovery, using it in the form of paraffin once more to light our rooms? What would have been said of any one ten years ago who spoke of analysing the atmosphere of

the sun? We must be prepared for startling discoveries in this glorious science. Whatever I have said generally of manufacturers applies more particularly to Glasgow. This city has great reason to be proud of its chemical factories—nearly every known branch is here represented. Long before the stranger who approaches Glasgow sees the flames of her forges, or hears the sound of her hammers, his attention must be arrested by her tall chimney shafts; the masts to which her chemical flag is nailed, and her manufacturers' challenge held high before the world. If a factory can be measured by its height, one of these stands distinguished and pre-eminent. Humboldt called chemistry "the Egyptian art," and unless it should return to that country, and one of the pyramids be converted so that it "draws" even better than at present, our friend Mr. Townsend will still reign without a rival, and never be able to compete with any one his own size. Glasgow is no less distinguished for its scientific chemists—Thompson, Ure, and a long list of names form a brilliant scroll. Here, then, of all cities, the scientific stranger will expect to find one of the best chemical societies in the kingdom. Gentlemen, you and I know how much he would be disappointed. We are all to blame, but let us now make a move. This is an opportune time. The Government is at last awakened to the necessity of scientific education. The British Association, the Society of Arts, the Paris Exhibition, have all joined in one cry, which must be heard—scientific education for our people. Let us commence by forming a section of the Philosophical Society, where chemical subjects can be brought forward in a crude state and discussed. Scientific chemists and manufacturers are both required to work out some purely scientific subjects from which they would derive mutual profit. Let it not be said that the birth-place of Thompson, Graham, and Stenhouse cannot keep up a chemical society. If we do not make an effort now the chemical world will move on, and we shall be left behind." The following toasts were also given:—"Scientific Chemists," by the croupier, responded to by Professor Anderson; "Manufacturing Chemists," by Dr. Wallace, responded to by Mr. Galbraith; "Foreign Chemists," by Mr. Sutherland, responded to by Dr. Mertz; "Chemical Brokers," by Mr. Turnbull, responded to by Mr. Leisler. Several other toasts followed, and a very agreeable evening was spent.

Obituary.—MR. WARINGTON, F.R.S., the distinguished chemist, died on November 12th, at Budleigh, Salterton, Devon. So many benefits have been conferred upon chemists by Mr. Warrington's zeal, that his decease will be a matter of general regret in the profession. His life seems to have been pre-eminently a life of public activity. He may be said to have founded the Chemical Society; upon its establishment he became secretary, a post he retained for many years. He also obtained the same responsible position in the Society which has rendered so much service to chemists in publishing a translation of Gmelin's Handbook—the Cavendish Society. These are not the only public positions in which he has figured; he was a juror of the Chemical Section of the International Exhibition of 1862, co-editor (Dr. Redwood being the other) of the British Pharmacopœia, 1867, besides having a hand in the production of some other works on pharmacy and allied matters. Mr. Warrington has undertaken many researches. A vast number of papers were published by him on various subjects in chemistry and pharmacy; some of these are to be found in the *Philosophical Magazine*, but the majority in the *Chemical Gazette*. We append a list of some of the more important. On improvements in the operation of tanning; on refining gold; on the formation of Prussian blue on the surface of gravel; on the action of weak acids on vessels plated by the electrotype process; on the action of alkalies on wax; on chemical symbols; on a curious change in the molecular structure of silver;

on molecular changes in solid bodies; on the green glass of commerce; on some properties of animal charcoal; on the preservation of animal and vegetable substances; on chromic acid; a process for estimating the value of the materials used in tanning; on the production of coloured films by electro-chemical influence and by heat; on a new yellow dyeing agent; on the production of boracic acid and ammonia by volcanic action; on biniodide of mercury; on the determination of phosphoric acid by magnesia. Mr. Warrington held the office of chemical operator at the Society of Apothecaries for upwards of twenty years. He retired from the profession last year.

DR. DAUBENY.—With deep regret we announce the death of Dr. Daubeny, Professor of Botany, Oxford, whose contributions to the cause of science have often appeared in our columns. He was a son of the Rev. James Daubeny, Rector of Stratton, and was born in 1795. He was educated at Magdalen College, Oxford, where, in 1814, he took the degree of B.A., when he was second class in classics. In the following year he gained the Chancellor's prize for an essay. He afterwards obtained a lay fellowship at Magdalen, and applied himself to the study of medicine, taking the degree of M.D. In 1822 he was elected to the Professorship of Chemistry, and in March of the same year he was elected a Fellow of the Royal Society. In 1829 he entirely relinquished the practice of his profession, and devoted himself to the study of the physical sciences. During the year 1834 he was elected to the Professorship of Botany, and he was also curator of the Botanical Gardens at Oxford. In 1841 Dr. Daubeny became a fellow of the Chemical Society, of which at the time of his death he was Vice-President, having previously filled the office of President. Dr. Daubeny has written several works, among them may be noticed "A Description of Active and Extinct Volcanoes;" "An Introduction to the Atomic Theory;" "Lectures on Roman Agriculture," &c. Amongst his contributions to the Chemical Society may be mentioned a paper on the power possessed by the roots of plants of rejecting poisons, and also one on "Ozone," which embodied the results of an extensive series of experiments and meteorological observations made at Torquay and Oxford. He died at the Botanical Gardens, Oxford, on December 12.

CONTEMPORARY SCIENTIFIC PRESS.

(Under this heading it is intended to give the titles of all the chemical papers which are published in the principal scientific periodicals of the Continent. Articles which are merely reprints or abstracts of papers already noticed will be omitted. Abstracts of the more important papers here announced will appear in future numbers of the "Chemical News.")

Journal des Fabricants de Papier.

August 1, 1867.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper Making. (Continuation.) Prussian Blue." Z. ORIOLI and HENRY, "An Agitator for Preparing Solutions of Chloride of Lime." C. ORTS-VANDENBERGHE, "A Process for Rendering Canvas, Tissues, Paper, Pasteboard, &c., waterproof." A. SWAN, "An Improved Apparatus for Evaporating and Recovering Spent Lyes." B. C. TILGMAN, "An Improved Method of Treating Vegetable Substances for the Manufacture of Paper Pulp."

August 15.

E. BOURDILLIAT, "On Testing the Chemical Products used in Paper Making. (Continuation.) Acetate of Iron, Sulphate of Copper, Acetate of Copper." J. L. BREBANT, "On the Use of Waste Fabrics for the Manufacture of Pasteboard."

Archives des Sciences.

August 25, 1867.

C. MARIGNAC "On the Separation of Niobic Acid from Titanic Acid, and on an Analysis of Aeschynite."

Kunst und Gewerbeblatt.

July, 1867.

F. MOIGNO, "On an Animal Charcoal Filter on H. Danchell's principle, manufactured by the London Water Purifying Company." T. WEGLER, "On Disinfection." "On the Manufacture of Plastic Charcoal." HAILER, "On the Impurities of the Coals of Upper Bavaria." R. WAGNER, "On the Detection of Cotton in Silk Yarn and Fabrics." "On Mandarin Yellow, a new Colouring Matter prepared from the Refuse of Cider Making." E. DIETRICH, "Note on the Preparation of Indigo Carmine."

L'Invention.

September, 1867.

J. GREEN. "On the Disinfection of Petroleum." SALVERT, "On Brianchon's Pearl Glaze for Glass and Porcelain." *Journal für Praktische Chemie.*

August, 1867.

C. MARIGNAC, "On R. Hermann's Researches on the Atomic Weight of Tantalum, Niobium, and Ilmenium." A. KENNGOTT, "On the Alkaline Reaction of some Minerals."

Bulletin de la Société d'Encouragement.

July, 1867.

F. C. CALVERT, "On Phenic Acid and its Properties." TESSIE DU MOTHAY, "A Method of Preparing Oxygen and Ozone from the Alkaline Permanganates." "On the Preparation of Oxygenized Water." S. HUNT, "On some new Methods of Smelting Ores of Use in New England." BALLARD, "On the Use of Silicic Acid for the Manufacture of Soap and for other Purposes." PAYEN, "On the Manufacture of German Yeast." DUMAS, "On the Silkworm Disease." PASTEUR, "On the Silkworm Disease." LENOIR, "An Improved Writing Telegraph." TRESCA, "On the Advantages of Armstrong's Accumulator for Hydraulic Apparatus."

Comptes Rendus.

September, 23, 1867.

F. LUCAS, "On the Limits of Visibility of the Electric and other Light." J. L. SORET, "On the Intensity of Solar Radiation." J. KOLB, "Researches on Chloride of Lime."

Bulletin de la Société Chimique de Paris.

July, 1867.

LECOQ DE BOISBAUDRAN, "Some Experiments on Supersaturation." C. LAUTH and A. OPPENHEIM, "On the Action of the Chlorides of Terebenthine on Aniline and Rosaniline." P. P. DEHERAIN, "On the Use of Potash Salts as Manure."

August.

LECOQ DE BOISBAUDRAN, "On the Supersaturation of Saline Solutions." G. LEMOINE, "On the Transformation of Red Phosphorus into Common Phosphorus." BOURGOIN, "On Organic Radicals." P. P. DEHERAIN, "On the Use of Potash Salts as Manure."

NOTES AND QUERIES.

Lime Soap.—Can any of your friends tell me how to decompose lime soap, completely and quickly? The hydrochloric and sulphuric acid methods require too much boiling to pay.—A. B. E.

Bone Boiling.—Your correspondent, "Oss," making inquiry as to means to abate the nuisance or smell of bone boiling, or rendering fats, as well as other kindred points, can receive the desired information by addressing H. S. B., Box 4968, P.O., New York City.—H. S. BRADFORD.

The Bichromate Battery.—In reply to "Clericus," I frequently use the bichromate battery with a Ruhmkorff's coil. Its action is considered as "intense" as a "Grove's," but it is less constant. This defect is to a great extent remedied by the usual form in which it is constructed, viz., with a means of raising the zinc out of the solution whenever it is required to stop the current, thus economising its power. The zinc should be amalgamated, and the cold saturated bichromate solution mixed with a twelfth part by measure of sulphuric acid. One great advantage of this battery is that it gives off no fumes.—F. BADEN BENDER.

Extraction of Oil.—Dyeing Turkey Red. Can any of your readers give me information relating to the use of bisulphide of carbon in extracting oil from liquors with which it is mixed, such as a solution of olive oil, pearl-ash ley, and water, and if an apparatus for this purpose should be expensive? Also, I should like to know if hyposulphite of alumina is at present in use as a mordant for Turkey-red dyeing, and if any of your numerous correspondents can supply me with a good practical process for dyeing Turkey-reds, both in cloths and yarns, similar to what is at present pursued in some of the large establishments in Lancashire.—E.

China Clay.—I deal largely in china clay, and find curious differences in the purity of certain lots—for instance, three months ago I delivered a maker of sulphate of alumina fifty tons, about which no fault was found; but six weeks after, when the remainder of the cargo came to be delivered, it was found to give out sulphurous acid largely during calcination, and to yield, moreover, a bad colour in the manufactured article. Now the question arises, can this clay, lying as it did in sheds at Runcorn, absorb sulphurous acid from the atmosphere, which may escape from some of the large chemical works in immediate neighbourhood? I can give no other reason for the impurity.—ENQUIRER.

Receipt for Preparing Blue-black Writing Ink, which also serves well for Copying Ink.—Take of blue Aleppo galls five ounces and a half; powdered cloves, quarter of an ounce; purified sulphate of iron, an ounce and a half; sulphate of indigo (in the form of a thin paste), an ounce and a half; pure sulphuric acid, thirty-five minims; cold rain water forty ounces. Digest the galls when bruised with the cloves in twenty ounces of the water for one week, then pour off the liquor into another bottle and cork it. Then pour ten ounces more of the water on the galls and digest four days. Then pour liquor as before into bottle. Pour then the remaining ten ounces of the water on the galls, and digest four days. Then pour off liquor into bottle, and filter through French filtering paper, wringing out hard the refuse of the galls in a strong clean linen or cloth into the filter, so that nothing be lost. Add now the iron, and dissolve and

filter through paper. Then the acid, and shake. Then the indigo, and thoroughly mix it, and pass the whole through filtering-paper. Care must be observed that the indigo be mild, and not contain too much free acid.—J. H.

Bleaching Palm Oil.—Your correspondent, Mr. George Johnson, has failed to bleach palm oil from three causes. He has, first, the water condensed from the steam. 2. The dreg is left in the oil; and 3. He is too sparing of his materials. Let him try the following: "Boil the palm oil, either with steam, or in a pan with a fire under it, add half a hundred-weight of water to the oil in the pan before the fire is put to it, allow the whole to settle till next day, draw off the pure clear oil only into a clean dry palm-oil cask standing on end with the head out. For ten hundred weight, fourteen pounds bichrome, to which add as much boiling hot water as will dissolve two-thirds of the chrome; after a little stirring add to this thirty-five pounds of muriatic acid which will dissolve the rest, making a strong solution; have ready fifteen or twenty pounds of concentrated sulphuric acid, add the acid chrome solution to the oil, and stir for a few seconds, while stirring begin pouring the sulphuric acid, not too slow, until a strong dark green appears, then stop pouring the acid, stir for a second or two, and add 20 gallons boiling water, a little more stirring and the process is finished. About 7 or 8 lbs. of sulphuric acid should bring out the green. With all the materials ready at hand, the process should be finished in 3 minutes. These proportions, especially the acids, are in excess, but a little practice will enable G.J. to reduce the quantities. The agitation should be vigorous, not round about but from the bottom to the top, so as always to bring up the chemicals through the oil. P.S.—Don't bother much about the temperature.—G. H. W.

Water for Steam-boilers.—In reply to E. S. I., I beg to give the following information:—Your correspondent will hardly meet with a book on the subject alluded to, since it would be next to impossible to meet every special case. There exists a German work, the title of which is "Der Führer des Maschinenisten," bei C. F. Scholl, Civil Ingenieur, published at Brunswick by Vieweg and Sons, 6th edition, 1864. This thoroughly practical book contains a large amount of information which would be vainly looked for in books on steam engines. As regards the incrustations in boilers, it is not only the greater or less amount of mineral matters kept in solution by the water supplied to the steam-boilers which is to be considered, but also the presence of the steam, consequently the temperature to which the water is heated, the mode of supplying water to the boilers, and the place at which the feed pipes enter the same. As a general rule, a hard strongly adhesive incrustation is more due to the sulphate of lime than to the carbonate of lime. The latter, when no sulphate at all is also at the same time met with in the feed water, leaves a muddy slime rather than incrustation, provided, however, no alkaline salts be present at the same time, as, for instance, common salt; and provided also the pressure of the steam be kept comparatively low, at any rate below 45 pounds per square inch. There have been various means proposed to obviate the incrustation in steam-boilers. Some of these are really useless, or even injurious in many ways. A very useful mixture, which effectually answers the purpose, is the following:—1 hundred weight of catechu; ½ ditto of common salt, are dissolved in 226 gallons of water (best rain water if it is to be had, or soft clear river water). 10 lbs. of this mixture are daily sufficient to keep a boiler, which has to convert into steam, in 12 hours' time, 400 cubic feet of hard water, free from incrustation. The mixture is best pumped in along with the feed water. If E. J. T. will send his address I will give him a diagram and description of an apparatus never met with in connection with steam-boilers in this country, but very frequently found abroad, where no steam-boilers can be used without being under the supervision of properly qualified officers, and where no water is allowed to be used for steam-boilers but after taking every care with it so as to prevent explosions and accidents.—Dr. A. A.

TO CORRESPONDENTS.

James Y.—The copies cannot be sent, as you neglected to give an address.

J. S. P.—O'Neill's "Dictionary of Dyeing" will probably give you all you want to know. *L'Invention* is a French periodical; it can be ordered through any foreign bookseller.

J. G. Tatters.—Many organic ethereal bodies which contain sulphur, and some which are free from that element, have an offensive odour resembling garlic.

A. B.—We can give no idea of the prices. Your best plan will be to advertise for what you want.

T. IV Cowburn.—"Fresenius's Chemical Analysis, Quantitative and Qualitative," published by Churchill.

Communications have been received from J. Lonsdale; W. E. Brennon; D. Forbes, F.R.S.; W. Dennison (with enclosure); F. C. Samuels; Dr. H. Dobell; R. Boyd; G. J. Symons; S. Merrill; H. K. Bamber; W. Whitmore (with enclosure); Dr. Rohrig; J. Ford (with enclosure); D. Wilhelm; R. Oatley; F. Rose; C. P. Bahin; F. Cooke (with enclosure); H. Jackson; Gustav Trouvé; F. Schutzenberger; T. Jones; J. Pearson; M. Morris; J. Grimwood; A. E. Sansom; S. J. Mackie; W. Adams; F. Sutton; F. B. Bengier; T. Blair; J. Sutherland; W. A. Rosa; F. C. Calvert and Co.; E. Meldrum; Piesse and Lubin; F. Hodgson; D. Knight; W. Paterson; J. Walker; H. B. Condy; P. Squire; J. Frankau and Co.; G. W. Eccles; J. Slater; D. Swan, Junior; J. Henderson; R. Warington; J. Young; Dr. Atfield; Liebig Extract Meat Company; E. Wood (with enclosure).

Books Received.—"American Artisan;" "Bulletin de l'Encouragement;" "Journal of Gas Lighting;" "Chemist and Druggist;" "Scientific American;" "American Journal of Mining;" "American Gas-Light Journal."

PATENTS.

Communicated by Mr. VAUGHAN, F.C.S., Patent Agent, 54, Chancery Lane, W.C.

GRANTS OF PROVISIONAL PROTECTION FOR SIX MONTHS.

3191. F. L. de Gerbeth, Haggerstone, Middlesex, "Improvements in treating oils and spirits, and in apparatus to be used for this purpose."—Petition recorded November 11, 1867.

3275. W. J. Coleman, Bury St. Edmunds, Suffolk, and A. Coleman, Lombard Stret, London, "Improvements in the combination and mode of treating and employing certain preparations for various articles of food."—November 19, 1867.

3288. Baroness C. de Lavenant, Brixton Road, Surrey, "Improvements in coating metals and metallic articles for the purpose of protecting or preserving the same from oxidation and decay; also in the materials, machinery, and apparatus to be employed therein."—November 20, 1867.

3295. J. Townsend, Glasgow, N.B., "Improvements in the manufacture of soda and potash."—November 21, 1867.

3307. T. Burchell, Charlmonte Avenue, Kingston, county of Dublin, Ireland, "A new and improved process and machinery for the manufacture of soda-water and other aerated liquids."—November 22, 1867.

3340. J. P. Smith, Glasgow, N.B., "An improved mode of coating and uniting metals with metals."—November 26, 1867.

3360. H. F. Gardner, Boston, U.S.A., "Improvements in the means of, and apparatus for, treating metals and minerals, in order to produce their oxides or other chemical or mechanical combinations, and to separate metals from their ores or from their alloys."—A communication from G. A. Willard, Boston, U.S.A., and W. G. Adams, Franklin, Mass., U.S.A.—November 27, 1867.

NOTICES TO PROCEED.

2142. H. A. Dufréné, Rue de la Fidélité, Paris, "Improvements in preserving iron from oxidation."—A communication from A. Delcelier, Eu, France.

2146. S. Bonsall, Philadelphia, U.S.A., "Improvements in tanning, and in the machinery and apparatus to be employed therein."—Petitions recorded July 23, 1867.

3208. A. F. Gaidan, Nîmes, Gard, France, "Improvements in compressed or artificial fuel."—Partly a communication from L. Tresgot, Nîmes, Gard, France.—November 13, 1867.

3232. J. Clark, Ph.D., and A. Esilman, Glasgow, N.B., "Improvements in decomposing the sulphides of copper, silver, nickel, cobalt, lead, barium, strontium, and calcium, and obtaining copper, sulphur, and other products."—November 14, 1867.

3275. W. J. Coleman, Bury St. Edmunds, Suffolk, and A. Coleman, of Lombard Street, London, "Improvements in the combination and mode of treating and employing certain preparations for various articles of food."—November 19, 1867.

3295. J. Townsend, Glasgow, N.B., "Improvements in the manufacture of soda and potash."—November 21, 1867.

2180. P. A. Rohart, Rue du Canteleux, Douai, France, "Improvements in the manufacture of gases for the production of light, heat, and motive power, and in apparatus for that purpose."—July 27, 1867.

2198. A. Watt, Putney, Surrey, "An improved fertilising compost."—July 27, 1867.

2200. J. Jones, Little Bolton, Lancashire, "An improved chemical mixture or compound for extinguishing fires and destroying explosive fire-damp in coal mines."—July 30, 1867.

2213. G. Gordon, San Francisco, California, U.S.A., "Improved processes and apparatus to be used in the manufacture of sugar, and in sawing, cutting, or forming the same into cubes for use."—July 31, 1867.

2239. E. A. Kirby, Gordon Square, Middlesex, "An improved system of dispensing medicines and preparing drugs therefor, together with an improved portable miniature dispensary and instrument case applicable to such system."—August 2, 1867.

2264. J. Heaton, Langley Mill, Derbyshire, "Improvements in blast furnaces."—August 5, 1867.

2270. T. Luthringer, Lyons, France, "A new red colouring matter."—August 6, 1867.

2288. A. M. Clark, Chancery Lane, "An improved metallic alloy and in the applications of the same."—A communication from G. A. Schmitte, and H. A. Levallois, Boulevard St. Martin, Paris.—August 8, 1867.

2294. H. A. Avery and G. Penabert, Paris, "The application of a certain vegetable powder for removing and preventing incrustations in boilers."—August 9, 1867.

2337. J. A. Jones, R. Howson, and J. Giers, "Improvements in puddling and other furnaces employed for melting, boiling, or heating iron."—August 14, 1867.

2685. A. Giegele, Mincing Lane, London, "Improvements in the manufacture of Epsom salts."—A communication from Messrs. Vorster and Gruneberg, Cologne, Prussia.—September, 23, 1867.

An Introduction to Chemical Philosophy,
according to Modern Theories, by ADOLPHE WURTZ, F.R.S.
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THE CHEMICAL NEWS.

VOL. XVI., No. 421.

ON A NEW CLASS OF BODIES HOMOLOGOUS TO HYDROCYANIC ACID.*

By A. W. HOFMANN, LL.D., [F.R.S.

The new cyanides isomeric with the nitriles are not formed exclusively by the action of chloroform on the primary monamines. On perusing the papers describing the examination of the organic cyanides, we see at a glance that the chemists who investigated them have had in their hands at the same time the isomeric cyanides with which I am engaged.

In fact everyone who has distilled mixtures of sulphomethylate, sulphethylate, or sulphamylate of potassium with the cyanide of the same metal, will remember the repulsive odour possessed by the products so obtained. This odour only disappears in proportion as the product is purified, and especially after its treatment with acid, in order to remove the ammonia, and with oxide of mercury to separate the hydrocyanic acid.

Dumas, Malaguti, and Le Blanc, in their researches on the nitriles, mention the insupportable odour possessed by the cyanides obtained by the cyanide-of-potassium process; while the products obtained by the dehydration of the ammoniacal salts by means of phosphoric anhydride have a very agreeable aromatic odour.

In a research made by Mr. Buckton and myself on the transformations of the amides and nitriles under the influence of sulphuric acid, we repeatedly had occasion to prepare acetonitrile (cyanide of methyl) and propionitrile (cyanide of ethyl) by the distillation of a sulphomethylate or sulphethylate with cyanide of potassium. In our paper we mention substances of a formidable odour which appeared in these reactions, and we describe the efforts we made in order to isolate them. But as they are only formed in small quantity, we had to give up the attempt.

Mr. E. Meyer†, who has also been occupied with cyanide of ethyl, but who employed another method of preparation, encountered the same bodies. By acting on cyanide of silver with iodide of ethyl in sealed tubes, he obtained, together with iodide of silver, an unstable compound of cyanide of silver and cyanide of ethyl; and there was formed in the same reaction a liquid of an overwhelming odour. This latter, on distillation, presented the characters of a mixture from which it was impossible to isolate a product with a constant boiling-point. When treated with an acid the odour disappeared, and the solution contained ethylamine which was identified by the analysis of the platinum-salt. These are certainly the characters of the cyanides formed by the action of chloroform on the primary monamines; and it cannot be doubted that Mr. Meyer has had in his hands the ethyl term of the series of cyanides which I am studying, both in the combination with cyanide of silver and in the complex liquid which accompanied it.

If such results did not particularly attract the attention of chemists, it was owing to the fact that the author failed in ascertaining the complementary product of ethylamine, namely, formic acid. Mr. Meyer, besides, states that his research remained unfinished; and thus it will be understood how experiments otherwise so carefully carried out should have fallen into an oblivion from which neither the author nor any other chemist has endeavoured

to recall them during the many years which have elapsed since their publication.

In consequence of the examination of the bodies produced by the action of chloroform on the primary monamines, these old experiments have acquired a new interest; and it appeared to me, for more than one reason, that it would be desirable to repeat them, making use of the experience gained by my late researches.

For this purpose I have submitted cyanide of silver to the action of several organic iodides.

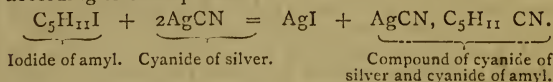
The iodides of methyl and ethyl act very slowly on cyanide of silver at the ordinary temperature; but the reaction takes place at the temperature of boiling-water.

After a digestion of about ten hours, the transformation is complete; a brown solid matter is formed, having the appearance of paracyanogen, together with a yellowish oily layer possessing in a marked manner the odour of the isomers of the nitriles.

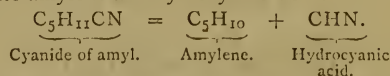
As several preliminary experiments gave indications of a rather complicated reaction, and as it would have been difficult for me readily to obtain sufficient substance by operating in sealed tubes, I performed the experiment in the amylic series, supposing that the higher boiling-point of the iodide of amyl would render it more easy of attack. My expectation was indeed fulfilled; two molecules of cyanide of silver and one molecule of iodide of amyl act on one another with extreme violence at the boiling-point of the latter. It is convenient to operate on a moderate scale, so as to be carefully protected from the escaping gases, which consist of equal volumes of amylene and hydrocyanic acid, mixed with a small quantity of the cyanide of amyl.

The experiment was made in a retort adapted to the lower end of a condenser, the upper end of which was connected with a series of washing-bottles. In the first a small quantity of cyanide of amyl was condensed; the second contained water intended to absorb the hydrocyanic acid; the third one water and bromine in order to transform the amylene into bromide, of which I was thus enabled to collect a considerable quantity during my researches.

After an hour's digestion, the reaction is finished, and the residue in the retort consists of a dark viscous mass, becoming almost solid on cooling; this is a mixture of iodide of silver and a combination of cyanide of silver and cyanide of amyl. The reaction then takes place according to the equation:—



But simultaneously a certain quantity of cyanide of amyl splits into amylene and hydrocyanic acid:—



This secondary transformation depends principally on the manner in which the operation is conducted; it may give rise to very great loss if the action be rather tumultuous.

It was now necessary to separate the cyanide of amyl from the residue in the retort. Up to the present time I have found no other means of effecting this than by submitting the residue to dry distillation; in this operation a further quantity of hydrocyanic acid and amylene is disengaged, and a liquid distils over, which on rectification boils between 50° and 200°. By submitting it to fractional distillation it was found that the first part still contained a quantity of amylene, whilst the latter products had become inodorous. The intermediate portion, rectified several times, finally exhibited a constant boiling-point between 135° and 137°.

The liquid which distils at this temperature is perfectly pure cyanide of amyl. It possesses all the properties which I have described in my previous communication, and is characterised especially by its odour and by the facility

* Paper sent to the Royal Society during the recess.

† Journal für praktische Chemie, vol. lxvii. p. 147.

with which, under the influence of hydrochloric acid, it splits into formic acid and amylamine. I have not yet completely examined the products boiling at a higher temperature, but everything seems to show that they consist, partly, at least of caponitrite.

The experiments which I have just described show, in a positive manner, that the same bodies can be obtained by the action of chloroform on the primary monamines, and by the treatment of cyanide of silver with the alcoholic iodides. In the latter process many secondary products are obtained; but by a more complete study perhaps it may be modified so as to diminish their quantity.

However this may be, the study of the action of the alcoholic iodides upon silver-salts deserves to be resumed; and it is very probable that in many cases it will be found that the bodies so produced will be but isomeric with those obtained by the ordinary processes.

For the special researches in which I am engaged at the present time, the observations just described have a particular interest; they permit us, in fact, to produce the isomeric cyanides without first preparing the primary monamines; they are especially important with reference to the generation of the polycyanides. The polyamines, in fact, are little, if at all, known up to the present, whilst the iodides of methylene and ethylene and iodoform are easy to procure.

If I have not yet succeeded in preparing a dicyanide of ethylene $C_4H_4N_2$, isomeric with Mr. Maxwell Simpson's cyanide, it is because I have not had at my disposal a sufficient quantity of ethylene-diamine. I now hope to obtain this body by submitting cyanide of silver to the action of iodide of ethylene.

In conclusion, I may be permitted to announce as very probable the existence of a series of bodies isomeric with the sulphocyanides. Already Mr. Cloez has shown that the action of chloride of cyanogen on ethylate of potassium gives rise to the formation of an ethylic cyanate possessing properties absolutely different from those belonging to the cyanate discovered by Mr. Wurtz. On comparing, on the other hand, the properties of the methylic and ethylic sulphocyanides with those of the sulphocyanides of allyl and phenyl, we can scarcely doubt that we have here the representatives of two groups entirely different, and that the terms of the methylic and ethylic series, which correspond to oil of mustard and to the sulphocyanide of phenyl, still remain to be discovered. Experiments with which I am now engaged will show whether these bodies can be obtained by the action of the iodides of methyl and ethyl on sulphocyanide of silver.

I must not conclude this note without expressing my thanks to Messrs. Sell and Pinner for the hearty co-operation that they are giving me in these researches.

CARBOLIC OR PHENIC ACID AND ITS PROPERTIES.*

By Dr. F. CRACE CALVERT, F.R.S., &c.

(Continued from page 298.)

I shall now have the pleasure of calling your attention to the production of two new colouring substances derived from picric acid:—

1. Picramic acid was, in the first instance, obtained by Wöhler; by making sulphate of iron act upon picric acid, and neutralising with caustic barytes, when a deep brown salt was produced, from which he separated the baryta by the help of sulphuric acid, and by these reactions M. Wöhler obtained an acid to which he gave the name of nitro-hematic acid; but it is to M. Aimé Girard that we owe the practical process by means of which we are able to manufacture great quantities of picramic acid.

This acid imparts to silk a beautiful series of brown tints similar to those obtained from catechu.

2. Isopurpurate of ammonia. It is with much pleasure that I noticed, at the Exhibition, in M. Casthelaz's case, a coloured substance, known in the trade by the name of soluble garnet, which, I am informed, is used especially by M. Chalamel, of Puteaux; this substance is particularly remarkable, as it is isomeric with the *purpurate of ammonia* or *murexide*. Although the preparation of this material was first pointed out by M. Carey, still it is really due to a previous observation, by Hlasiwicz, who called attention to the reaction of cyanide of potassium upon picric acid, and to which chemical reaction we owe the knowledge of manufacturing the isopurpurate for industrial purposes.

Before taking leave of picric acid it may not be without interest that I should state a curious application which has been made of the explosive property of its salts. During these last few years the picrate of potassium has been employed in great quantities by Mr. J. Whitworth, for charging the bombs for destroying the iron plating of ships. When the projectiles thus prepared strike the iron masses, the enormous propelling force with which they are expelled from the gun is instantaneously converted into heat, and to such an extent that the ball becomes red-hot, the heat decomposes the picrate of potash, and a violent explosion ensues, owing to the enormous quantities of vapours and gases which are thus produced in an instant of time. Whilst the alkaline picrates are endowed with such formidable properties, they also possess others which are useful for the alleviation of human misery. Picric acid is an efficacious remedy in intermittent fevers. Persons affected with such types of fever, upon whom quinine has lost all its beneficial effects by continuous usage of it—and this is the case with some of our soldiers who return from India—derive, I am glad to say, wonderful benefit from the use of picric acid and picrates, as Dr. Aspland has proved to be the case at the military hospital at Dukinfield. The knowledge of this fact may be useful in districts in which poor populations exist, for it affords them a cheap febrifuge; and, moreover, picric acid is not dangerous, as arsenical preparations are, nor does it derange the stomach like quinine.

To return to the colours derived from carbolic acid, allow me to remind you that when, in 1834, Runge discovered phenic acid amongst the products of coal-tar, he observed the existence of two colouring substances, to which he gave the name of rosolic acid and brunolic acid.

I will not detail here the processes by which Runge extracted these substances from the residue of coal-tar by means of lime, nor the method adopted by Messrs. Smith, Dussart, and Jourdin, for producing these substances by direct oxidation of phenic or carbolic acid, but will describe rapidly the process which we now use to manufacture rosolic acid, and which should not be attributed, as is generally believed, to M. Kolbe, as it is due to M. Jules Persoz, the son of the celebrated professor of tinctorial chemistry in the Conservatoire des Arts et Métiers. His process consists in making oxalic acid act upon sulphophenic acid at a temperature of about 160°, and the product which results from it has the bronze green appearance of cantharides. To render it suitable for employment in dyeing, it is only necessary to wash it so as to separate from it all the sulphuric acid with which it is contaminated. It is then sold under the name of yellow coralline or aurine. It was our firm who first, in 1863, discovered that rosolic acid thus prepared could be employed directly as a dye, and introduced it to dyers under the name of aurine. This substance gives to silk and albumenised cotton magnificent orange colours, like those of basic chromate of lead or of turmeric. In 1860, M. Persoz, jun., discovered also that if rosolic acid was heated under pressure with ammonia it gave rise to a red substance, which he called *péonine*. Messrs. Guinon, Marnas, and Bonnet perfected the manufacture of *péonine*, and gave it

* Lecture before the Society for the Encouragement of National Industry in France.

the name of red coralline. This colouring substance gives to silk and worsted a flame-coloured tint and brilliant scarlets. This firm was also the first to produce and introduce, towards the end of 1860, a blue dye, derived from carboic acid, or, more so, resolic acid, which they called azuline. Azuline is obtained by heating for several hours, at a temperature of about 180°, a mixture of rosolic acid and aniline. It is only necessary then to treat this product with sulphuric acid, and to wash it with benzine, to produce a beautiful blue colouring matter, which presents, when dry, a red mass with gold-coloured tints. Azuline, although discovered before the aniline blues, which have since become formidable rivals to it, is still, I may add, manufactured in competition with them.

To Messrs. Guinon, Marnas, and Bonnet is also due the first production of a green derived from coal-tar products. It was manufactured in 1863, therefore some months before the appearance of an aniline green, known as *vert d'Uzebe*, which, however, with the exception of the iodine greens, is the only one now employed in dyeing. Viridine was obtained by this firm from a mixture of aniline, benzoic, and resolic acids.

Phenicienne, discovered in 1863 by M. Roth, is another colouring matter derived from phenic acid; it produces fast colours, from a deep garnet red to a golden buff. Phenicienne is produced by the action of nitrosulphuric acid upon carboic acid.

I will now, with your permission, gentlemen, leave for a few seconds the products derived from phenic acid, in order to place before you certain claims to some inventions not sufficiently recognised by writers on aniline colours. In 1860, Messrs. Clift, Lowe, and I, took out a patent for the direct production on prints, of a green called emeraldine, and the deep blue called azurine, a blue which resembles indigo, and which really, when printed in a concentrated form, may be confounded with a black. And although I do not desire to deprive Messrs. Lightfoot, Carlos Kœchlin, and Lauth, of any of the merit which belongs to them for the production of the beautiful black which every one must have admired in the Exhibition, still I may be permitted to remark that their process is based upon the oxidation of aniline by chlorate of potash, and is therefore based on our patent, previously secured to their discoverers. The difference between their process and ours consists in the addition of a salt of copper, which addition is so important that I have no hesitation in saying it has decided the success of a black which now stands unrivalled.

I cannot conclude this retrospective view without calling your attention to a fact which seems to have escaped my colleagues; it is that the majority of the beautiful colours obtained from aniline are due to the industrial application of a discovery made by your illustrious president, M. Dumas, more than thirty years ago. The discovery I mean is the principle, so rich and fruitful, which he named the law of substitutions—a law which has thrown so bright a light on modern chemistry, and which has prepared the way for such brilliant achievements, and which, I say, has also been the foundation of the production of the beautiful colouring substances which we all so much admire. Thus, in order to obtain aniline blues, violets, and greens, produced by the methods devised by the illustrious chemist, Dr. Hofmann, we substitute for a certain proportion of the hydrogen of rosaniline, an equivalent quantity of the alcoholic radicals, called phenyl, ethyl, methyl, and amyl. Further, this celebrated chemist has also shown that the blue obtained by Messrs. Girard and Delaire are also due to the same laws.

I am far, I regret to say, gentlemen, from having named all the remarkable properties and applications of carboic or phenic alcohol; but I trust I have succeeded in making you share my enthusiasm for this valuable agent, which, after having rendered important services to most of the world's industries, still offers to chemists and to manufacturers a wide field for new applications.

PROCEEDINGS OF SOCIETIES.

CHEMICAL SOCIETY.

Thursday, December 19.

Dr. WARREN DE LA RUE, F.R.S., &c., President, in the Chair.

THE minutes of the previous meeting were read and confirmed. Messrs. Alfred Coleman and A. A. Wood were formally admitted Fellows of the Society; and Dr. W. F. Smith, Glossop Road, Sheffield, and Mr. Alfred E. Fletcher, Inspector of Alkali Works, Johnston, near Prescott, were duly elected.

The names of candidates read for the first time were—Herbert M'Leod, Assistant Chemist in the Royal School of Mines, 61, Bridge Street, Southwark; Thomas Charlesworth, Leicester; Robert Schenk, 10, Hanover Place, Kennington; and John Wallace Hozier, B.A., Oxon, Lieutenant 2nd Dragoon Guards, Staff College, Sandhurst.

For the second time were read the names of the following:—Peter Greiss, Burton-on-Trent; Gilbert W. Child, M.D., St. Giles', Oxford; Edward Chapman, Lecturer in Natural Science at Merton College, Oxford, (Frewen Hall, Oxford); William George Mason, Escrick, near York; and Alexander Walker, Captain Royal Artillery, Bengal Presidency, 18, Sussex Place, South Kensington.

Mr. ALFRED TRIBE then read a short paper "*On the Freezing of Water and Bismuth.*" The author quoted an extract from Professor Tyndall's "*Heat as a Mode of Motion*" (page 84), in which it is asserted that the anomalous expansion of water in the act of cooling below 4°C. is by no means an isolated instance of the kind, but that other bodies, and particularly molten bismuth, participate in this extraordinary property of expanding near the point of solidification. After making experiments upon this subject, Mr. Tribe arrives at the conclusion that the analogy between water and bismuth is imperfect, since in the case of the molten metal there is no perceptible range of temperature through which it expands on cooling. The act of solidification is itself accompanied by an increase in bulk, but there is no evidence of this expansion taking place prior to the act of crystallisation.

After a few words in support of Mr. Tribe's conclusion had been offered by Dr. J. H. Gladstone, the President, at an early hour, moved the adjournment of the meeting for the purpose of enabling the members to be present at the delivery of the Bakerian lecture before the Royal Society. Dr. Roscoe, the lecturer, described his recent "*Researches on Vanadium.*"

At the next meeting, January 16, Dr. Frankland will deliver a discourse "*On Water Analysis*;" and on February 6, Dr. Russell, "*On Gas Analysis.*"

DUBLIN CHEMICAL AND PHILOSOPHICAL CLUB.

Dec. 12, 1867.

"*The Action of Ozone on Sensitive Photographic Plates.*" Dr. Emerson Reynolds stated that he had been performing some experiments upon the above subject, and that he had found that when the latent image (*i.e.*, the image before it is developed) was submitted to the action of ozone, it was completely obliterated—not only was it impossible to develop the image, but a second image might be retaken in the camera upon the same plate. The author remarked that this was against the theory which might be called the mechanical theory of photographic

images, and proved conclusively that it was due to chemical change in the sensitive film. He also thought that many of the disputes in connection with the length of time dry plates might remain sensitive, was probably owing more or less to the quantity of ozone present in the air.

The ozone used in these experiments was in some cases procured by passing atmospheric air over phosphorus, and in others by the silent discharge, viz., by attaching one of the platinum wires of the reservoir to the prime conductor of a machine, and turning it slowly, the other wire being in communication with the ground.

"Nitrite of Amyl."—Mr. Tichborne brought before the notice of the meeting a statement by Mr. Chapman, which appeared in the *Laboratory* of August 31, namely, that nitrite of amyl was not decomposed by heat, as stated by Mr. Tichborne. The speaker had not considered the matter of sufficient importance to enter into a written dispute with that gentleman, but felt that it was due to the members of the society to prove that Mr. Chapman was in error, more particularly from the fact that the observations, to which Mr. Chapman took objection, were first brought forward at one of their meetings of the previous session. Mr. Tichborne said his note was merely published with a view to correct some erroneous descriptions of nitrite of amyl which were given in the manuals of chemistry. The speaker found that the redness of the vapour (described as a specific property of nitrite of amyl) was due to a partial dis-association of the elements and the consequent elimination of binoxide of nitrogen.

Mr. Chapman, on the contrary, "was of opinion that nitrite of amyl was an ether of great stability." "That when once obtained tolerably pure it would bear distillation without undergoing any appreciable decomposition." Now, although Mr. Tichborne had no doubt that Mr. Chapman's general observations in connection with this substance were very exact, he was compelled to take exception to this point. He found that the perfectly neutral nitrite became instantly acid on ebullition, and gave off binoxide of nitrogen; that this decomposition which was however comparatively partial, continued during the whole of the distillation, and was as decided at the conclusion of the operation as at the commencement. Also that pure nitrite of amyl by spontaneous decomposition became acid and charged with oxides of nitrogen. Mr. Tichborne then showed an experiment which illustrated and conclusively confirmed his remarks.

A sample of nitrite of amyl was taken which had been made after the plan recommended by Mr. Chapman, viz., by passing nitrous acid through amylic alcohol, the latter having been previously purified by fractional distillation; it had been treated with dry carbonate of sodium, and was therefore quite free from the acid products of decomposition. Half of the specimen was poured into a solution of starch and iodide of potassium; no change was manifested, showing that the specimen was free from any absorbed binoxide of nitrogen*. The other half of the specimen was then placed in a small retort, the vapour from which was passed through the same mixture of iodide of potassium and starch. Heat having been then applied to the nitrite of amyl in the retort, the first puff of gas that escaped through the mixture instantly determined a copious deposition of blue iodide of starch.

Dr. Frazer, in showing some interesting minerals, remarked that glycerine would be found to be a very useful material for preserving lanmonite (efflorescing zeolite) and such like minerals that lose their water of hydration. Thus he had kept specimens for years by smearing them with a little glycerine, and what would naturally be destroyed in a short time when placed dry in a cabinet, were by this means kept perfectly safe.

A LECTURE EXPERIMENT.

THE presence of earthy or alkaline carbonates in spring or river water, &c., may readily be shown by adding a small quantity of a freshly prepared decoction of logwood, when a more or less deep purplish-red colour is produced. With distilled water only a slight reddish-yellow colour is observed. The experiment may conveniently be performed by adding an equal quantity of the logwood solution to the water or waters to be tested, contained in glass jars or beakers, placed on white paper, a similar jar of distilled water being used for comparison. The solubility of carbonate of lime in pure water, may be shown by placing some pulverised calc-spar on a properly purified filter and allowing distilled water to pass through it; on adding a few drops of the logwood solution to the filtrate a deep purplish red colour is immediately produced. An alcoholic solution of alizarine may be used instead of the logwood decoction; with distilled water a yellowish colour is produced, but if any alkali or alkaline earth be present, a violet colour is developed, especially on application of a gentle heat. Of course in using the above tests to show earthy carbonates in water, care must be taken that no alkali is present. J. W. Y.

MISCELLANEOUS.

Royal Institution.—Professor Tyndall, F.R.S., will deliver juvenile lectures on "Heat and Cold," on Tuesday, Thursday and Saturday next, at three o'clock.

Science as a Part of Education.—The following is the concluding passage of the last of a course of chemical lectures recently delivered at Eton College by Mr. G. F. Rodwell:—"In conclusion, let us consider the nature of the various processes which we have studied. Let us enquire by what means we have been enabled to produce the different chemical changes which have been brought before us. These changes have been effected by inducing in matter unnatural and forced conditions; by influencing substances either externally or internally by superadded actions; or by the removal of a prevailing force which prevented the prominent assertion of chemical affinity. '*Occulta natura*,' says Francis Bacon, '*magis se produnt per vexationes artium, quam cum cursu suo meant.*' From the beginning to the end of this course we have extracted our knowledge by thus harassing and vexing nature. The tearing asunder of combined atoms; the separation of atoms from one form of combination, and the compelling them to unite otherwise; the addition or subtraction of vibrating motion. These are the actions which have enabled us to gain some insight into the working of the force called chemical affinity. Of the actual nature of chemical affinity we know nothing; we can only regard it as an attractive force exerted between dissimilar atoms, acting through an insensible space, and varying in intensity as the atoms vary in composition. Chemical affinity can only be studied through its actions, and the greater number of the processes which we have employed have been for the purpose of eliminating the action of certain forces so as to cause chemical affinity to be the dominant force during the continuance of the experiment. These studies are to be viewed as a means to an end. The primary object of science teaching is not to make you acquainted with its applications to the useful purposes of life, but to induce in you that exact and discriminative mode of thought which is inseparable from the right study of physical phenomena. Why I say that to thoroughly master the vibratory motion theory—theory though it be—as applied to the explanation of chemical phenomena, is better, as a mental exercise, than the knowledge of fifty of the applications of chemistry. Do not let your science be of too practical a character. Remember that science applied

* Nitrite of amyl absorbs binoxide of nitrogen very readily, and when first prepared is more or less charged with this gas. "Probably these circumstances induced Mr. Tichborne to regard the ether as decomposable on boiling."—*Vide* Mr. Chapman's note in *Laboratory*, August 31, 1867.

to the useful arts—to the making of dyes, the extraction of metals, the manufacture of coal-gas—has ceased to be pure science. It is not such science as this that I would have you study. True science must have as its primary objects the search for truth, the investigation of causes, the enlargement of our knowledge of the various agencies which are at work around us. It is to be built up mainly of well-verified experimental facts and of theories readily deducible from them. The former are to be received as absolute; the latter as liable to change. That such change is inevitable will be obvious when we remember that in the present state of science we are all—both those who theorise and those who work out the facts upon which theory is supported—all alike are boys, and listeners, and learners in the school of nature."

Counterfeit Creosote.—A large proportion of ordinary creosote is simply carbolic acid. But the pure creosote, which constitutes the lachrymosal property and peculiar smell of smoke, is quite a different substance, and may be distinguished from the false, as shown by Rust, by its behaviour with collodion. A mixture with this latter and carbolic acid gives a gelatinous precipitate, while with true creosote the collodion remains clear. Dr. Hager gives another test. To a weak solution of iron, a few drops of ammonia are added until the precipitate, which originally forms, is dissolved. Carbolic acid communicates a blue or violet tinge to the solution, while genuine creosote gives a green colour, afterward turning to brown. —*Scientific American*.

Dessicated Egg.—Mr. Charles Lamont has discovered and patented a very ingenious process for preparing eggs so that they may be kept for years without change or decay. The process consists in emptying the fresh eggs from the shell into a long covered trough; a shaft, armed with a series of metallic discs about 15 or 20 inches in diameter, is made to descend into this trough while revolving, which beats the eggs into homogeneity, and covers the surfaces of the discs with a thin covering of egg. The discs still revolving are elevated from the trough, and a current of hot air passed through the covered box, which quickly dries the egg, when a series of scrapers are brought into action so as to scrape off the egg in the form of fine thin scales or granules, which have the appearance of being crystallised. This process may be repeated *ad libitum*. The preparation thus obtained retains, perfectly, all the properties and flavour of the fresh egg, and may be used for the various purposes where broken egg is needed, and for cooking, by dissolving a little in water and beating it as usual. One pound is equal to 44 eggs; 100 doz. eggs, when crystallised or dessicated, occupy one cubic foot. We are glad that this very useful article of diet has been added to the now long list of preserved articles of food. An enterprising company in New York have, we understand, purchased the invention, and it is now being successfully introduced into the market.

Crystallisations Produced by Means of the Blow-pipe.—It sometimes happens in experiments with the blow-pipe, when borax, phosphorus, salt or soda is used, that the bead, at first limpid, becomes suddenly opaque. M. G. Rose finds that this is due to the development of crystallised bodies in the interior of the mass. The crystallisation is often confused, although sometimes it is very regular, and on operating with titanium under sufficiently varying circumstances, M. Rose has been able to obtain anatase, and to effect the crystallisation of the two allotropic states of the titanate acid. With felspar and phosphorus salt (by the aid of which, as is well-known, silicates are reduced to silica and phosphates) he obtained crystallised quartz, confused, but insoluble in alkalis. In order to recognise the crystals obtained under these conditions, flatten the yet warm bead and observe it under a microscope, or it may be attacked by water or an acid, in which case the residual crystals may be collected on a glass plate.

Diffusion.—Some very elegant and simple methods of exhibiting the phenonema of diffusion are given by Herr Merz in a recent number of the *Journal für Praktische Chemie*. A portion of the shell of an egg having been removed by the action of hydrochloric acid, leaving the membrane exposed, the egg is to be suspended in water from the arm of a balance, a counterpoise being placed in the opposite scale. In about half an hour the weight of the egg has sensibly increased, as the position of the balance-beam will show, in consequence of the passage of water through the membrane. If, now, alcohol be substituted for the water, and the weights readjusted so as to bring the beam horizontal, it will soon commence to move in the opposite direction, showing that the egg has become lighter by the diffusion of water into the alcohol. The diffusion of vapour may be exhibited by tying a diaphragm of india-rubber—a portion of a small toy balloon will answer the purpose—over the mouth of a funnel, the other end being in communication, by means of an elastic tube, with a vessel of water. The funnel being inverted over a dish containing ether, which, however, the diaphragm is not to touch, the vapour of this fluid will pass rapidly into the funnel, the air being observed to escape in bubbles in the water at the small end. Remove now the vessel of ether, and the operation will be reversed, the vapour passing through the diaphragm into the atmosphere. In order to fill the vacuum thus created the water will rise in the tube, the lower part of which should be of glass to render this apparent, and the diaphragm will be curved inwards. These experiments are particularly instructive, and are within reach of every one. The balance may be extemporized by means of a light bar of wood.

Microscopic Crystallography.—Mr. H. S. Waddington, in a paper read before the Pharmaceutical Society, and published in the *Journal*, says that the formation of perfect crystals depends upon the rapidity with which they are deposited. He has obtained better results by allowing the crystals to deposit from a hot and concentrated solution, than placing a few drops of a cold saturated solution on a clean slide, and allowing it to evaporate spontaneously. When crystals are pretty soluble in water, the way of procedure is as follows:—A solution is made in hot distilled water, the liquid filtered, and a few drops poured on to a clean slide just before the crystals begin to form in the solution itself, and immediately poured off, sufficient will remain behind for the production of crystals, which will form at once. When of a sufficient size, the remaining liquor, if any, should be drained from them and the slide allowed to dry. The result will generally be a slide, evenly covered with crystals, having well-defined edges, and but few of which are agglomerated. This process answers well for alum, chlorate of potassium, nitrates of barium and strontium, potassio-tartrate of antimony, sulphate of copper, sulphate, acid tartrate, binoxalate, and quadroxalate of potassium, the strength being regulated by experience. If crystals are not very soluble in cold water, they may be allowed to separate in the bulk of the solution itself as it cools, then remove a small quantity of liquid and crystals to a slide by means of a glass tube. The slide must be kept moving to prevent the aggregation of the crystals, and the superfluous liquid removed by applying blotting paper to the edges of the slide. To obtain perfect crystals from substances generally met with in long prisms, Mr. Waddington finds the best method is to make a hot solution, containing rather more of the salt than would saturate it at ordinary temperatures. Having filtered and allowed it to become nearly cold, place a few drops on a slide, and draw a very fine glass rod across it. This method overcomes the difficulty of producing typical crystals. For hippuric acid, the solution, when on the point of crystallising, should be poured on to a cold slide, and when the crystals have formed, the remaining liquid should be poured off and the slide allowed to dry. Sugar, citric and tartaric acids, and all substances very soluble in water, may be obtained in crystals by making a concentrated solution, filtering it, and then

pouring on to a slide, taking care that only a thin layer of liquid remains, which should be allowed to dry in the air. To obtain crystals from sulphate of iodo-quinine or "Herapathite," the author mixes 3 drachms of spirit of wine and 1 drachm of acetic acid in which he dissolves 10 grains of bisulphate of quinine. He then pours 10 or 15 drops on to a slide and adds a drop of tincture of iodine. When clear he pours it from slide to slide as long as the liquid holds out. The best method of obtaining uric acid in crystals is to allow 8 or 10 oz. of urine to stand some hours after the addition of 2 or 3 drachms of acetic acid. In a day or two the crystals will have grown larger, when the bottle should be shaken to detach them from the sides, and then wash them with distilled water, acidulated with acetic acid. To obtain the rarer forms it is requisite to allow the crystals to deposit quickly, which may be done by making a solution of urate of sodium by boiling uric acid with solution of caustic soda until no more is taken up. If 1 or 2 drachms of this is put into 8 oz. of urine and a small quantity of acetic acid added, not more than sufficient to neutralize the soda, very perfect crystals will be obtained. Another deposit found in urine is the phosphate of ammonium and magnesium, or triple-phosphate, which may be prepared in prisms by dropping about 25 or 30 grs. of carbonate of ammonium into 8 or 10 oz. of urine, and allowing it to remain quiet for some hours. When the crystals are of sufficient size the bottle may be gently shaken and the urine poured off. This deposit may also be obtained in stellate crystals by adding 1½ to 2 drachms of carbonate of ammonium to urine, and allowing it to stand. The crystals should be washed with distilled water, to which a little liquor ammoniæ has been added. Calcic oxalate may be obtained by dropping a single small crystal of oxalic acid into 8 or 10 oz. of urine, and leaving it at perfect rest for some hours. Mr. Waddington has also obtained good results from salicin by pouring a saturated solution in cold water on to a slide, holding it over a flame until it is at the boiling point; then pouring off the slide, when only a viscid film will remain. This must become quite cold, and the under surface held close to the flame of a lamp or gas jet. The moment it begins to crystallise it must be removed a few inches from the flame, or else it will fuse.

Royal Polytechnic Institution.—The Christmas entertainments at this Institute were inaugurated on Saturday evening last with a grand dinner, followed by a conversazione. The company at dinner, included the following noblemen and gentlemen:—His Highness Prince the Maharajah Duleep Singh; his Grace the Duke of Wellington, K.G.; Viscount Strangford; the Rt. Hon. Lord Ernest Bruce; Capt. the Hon. F. Maude; Hon. A. Kinnaird, M.P.; Professor Wheatstone, F.R.S.; Professor Abel, F.R.S.; Erasmus Wilson, F.R.S.; Professor Pepper; Dr. Letheby; Wm. Crookes, F.R.S.; Robert Hunt, F.R.S.; Rev. J. B. Owen, M.A.; Professor Graham, F.R.S.; J. Glaisher, Esq.; J. Spiller, Esq., &c. The conversazione was very numerous attended, and the varied entertainments for the holiday season were rehearsed. Professor Pepper delivered a lecture on "Faraday's discoveries and their results, being real science as contrasted with unreal science called spiritual manifestations." Commencing with the discovery of bicarbide of hydrogen, the lecturer spoke of Dr. Hofmann's researches on benzol, which had been the means of producing the colours mauve and magenta since manufactured on a very large scale by the firm of Nicholson and Maule. He then dwelt upon Faraday's discoveries in electricity, explaining the construction of Wheatstone's bridge, &c. Mr. Apps also exhibited his new induction coil, with which a spark about four inches in length was obtained and other brilliant experiments performed. The lecture was closed with some extracts and observations on spiritualism, when Professor Pepper stated that Dr. Bence Jones had lent him a manuscript, which he had received from some one who professed to have held communication with Faraday's spirit, and that the latter was now a firm

believer in spiritual manifestations, and regretted he had not taught the truth when he was alive. During the evening the Polytechnic was placed in telegraphic communication with the United States, Paris, Manchester, &c., and the visitors were amused by receiving the following message from Newfoundland two or three minutes after its transmission:—"Temperature, 19° Fahr., wind, N.E., snow drifts in some places nearly 20 ft. deep." Mr. Ladd's dynamo-electric machine, machine-made jewellery, and various other ingenious novelties are introduced into the programme. We have no doubt the Institution will be well attended during the holidays; the programme is a very long one, and many other novelties are promised.

To Cement Brass on Glass.—Puscher uses a cement particularly adapted for fastening brass on glass lamps, which consists of a resin soap—made by boiling three parts of resin with one part of caustic soda and five parts of water—which is mixed with one-half its weight of plaster-of-paris. This cement has great adhesive power and is not permeable by petroleum; it sets firmly in less than an hour, and is a very slow conductor of heat. Zinc-white, white-lead, or precipitated chalk may be substituted for plaster of Paris, but the material will be longer in hardening.—*American Artisan*.

Iodine and Carbolic Acid.—Dr. Percy Boulton, to remedy the inconvenience attending the external application of iodine and its preparations, has adopted the method of adding a few drops of carbolic acid to the iodine solution to be employed. The formula is as follows: Compound tincture of iodine, 3 grms.; pure liquid carbolic acid, 6 drops; glycerine, 30 grms.; distilled water, 150 grms. This carbolate of iodine is not perfectly colourless, so that it may be applied with impunity; and it is not only one of the most powerful antiseptics we possess, but is intrinsically a more efficacious agent than iodine alone. In the form of injections, gargles, and lotions, for sore-throat, ozæna, abscess in the ear, &c., this preparation is a sovereign remedy.—*Extract from a letter in the Journal des Connaissances Médicales*.

New Test for Molybdenum.—In a former paper I stated that under certain circumstances sulphocyanide of potassium produced a magnificent red colour with molybdic acid. I have since thought to use this reaction as a test for the presence of molybdenum, and I find it extremely delicate, far more so than any other test yet employed.

Thus, molybdic acid dissolved in hydrochloric acid, and treated with sulphocyanide of potassium, gave the following results, when progressively diluted and shaken up with scraps of zinc.

Degree of Dilution.		Degree of Coloration.
One part molybdc acid in	.. 50,000	Dark.
" " " "	.. 150,000	Pale.
" " " "	.. 300,000	Very pale.
" " " "	.. 600,000	Faint.
" " " "	.. 1,000,000	{ Colour perceptible in small bulk.
" " " "	.. 2,000,000	{ Colour perceptible only in large bulk.

The presence of sesquioxide of iron does not interfere with this test if time is allowed for its deoxidation.

Tungstic acid similarly treated also gave a magnificent red or yellow colour, which however is not superior as a colour test to that at present used.—*William Skey, New Zealand*.

NOTICE.

With this number the present volume closes, and we have pleasure in informing our readers that in our next number, commencing volume XVII., will be published a verbatim report of the first of Professor Tyndall's Christmas Lectures at the Royal Institution, "On Heat and Cold." Other new features will also be gradually introduced into our pages during the ensuing year.

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